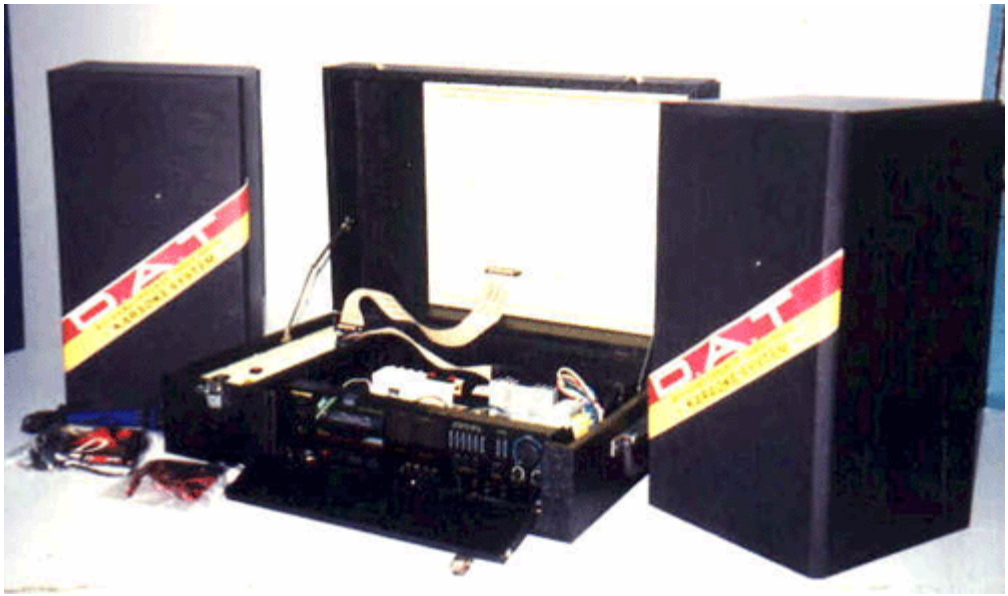
(EAV2A)
Stereo Hi-Fi Trainer



Item :Stereo Hi-Fi Trainer

The stereo hi-fi trainer is a modular system designed to demonstrate the principles of stereo hi-fi operation, theory, repair and servicing. The system is especially suited for the training of prospective audio service technicians. The trainer is based upon popular brand hi-fi stereo systems from famous manufacturers. A number of modules are offered, each of which is a complete trainer with electronic faults. The module format is based upon standard type components as found in many stereo systems. The modules can be purchased individually for specific training or together as a complete stereo system.

Each module is mounted on an attractive chassis, which allows the printed circuit boards to be exposed for ease of work. All circuit boards feature plexiglass covers, which have openings for, access to all tests points so as to allow insertion of probes while protecting the student and the circuit board. The trainer allows access to all the factory recommended key points for the taking of measurements, analysis and adjustments. A fault insertion system has been designed into the trainer so as to allow selectable faults to be simulated one each module for student instruction purposes. The above photo shows the compact disc trainer with the fault board attached, the other modules are shown in their operational mode.

Each trainer comes with complete courseware information as follows:

a) factory service manual.

b) student job sheets with fault guide and wiring diagram.

c) general book on servicing and theory.

The following modules are available

EAV-STR-1 Stereo Amplifier Trainer module
with 10 faults and display panel
Distortion: 0.10%
Frequency response: phono: 30 Hz - 15 KHz
Tuner/CD/AUX/tape: 10 Hz - 40 KHz
Inputs: tuner, tape, speaker, phono, CD, AUX
Power: 20 Watts continuous power
Power req.: 220Vac/50 Hz

Topics covered:
- introduction and characteristic of audio amplifier
- circuit analysis of audio amplifier circuit
- troubleshooting of an audio amplifier

EAV-STR-2 Integrated Stereo Tuner and Amplifier Trainer module
with 10 faults and display panel
Distortion: 0.10%
Frequency response: phono: 30 Hz - 15 KHz
Tuner/CD/AUX/tape: 10 Hz - 40 KHz
Onputs: phono, CD, AUX, tape, speaker
Power: 20 Watts continuous power
FM frequency range: 88 - 108 MHz
AM frequency range: 527 - 1605 KHz
Power req.: 220Vac/50 Hz

Topics covered:
- stereo tuner familiarization
- understanding stereo tuner circuit (AM and FM)
- combined stereo tuner and amplifier circuit
- troubleshooting stereo tuner and amplifier circuit

EAV-STR-3 Stereo Tuner Trainer module
with 10 faults and display panel
FM sensitivity: 1.0 microvolt
AM sensitivity: 20 microvolt
FM frequency range: 88 - 108 MHz
AM frequency range: 527 - 1605 KHz
Power req.: 220Vac/50 Hz

Topics covered:
- stereo tuner familiarization
- understanding stereo tuner circuit (AM and FM)
- stereo tuner circuit troubleshooting

EAV-STR-4 Tape Cassette Deck Trainer module
with 10 faults and display panel
Type: single cassette
WOW and flutter: < 0.1%
Frequency response :
Normal tape: 20 Hz - 15 KHz

CR02 tape: 20 Hz - 16 KHz
Metal tape: 20 Hz - 17 KHz
Dolby s/n ratio: 67 db
Power req.: 220Vac/50 Hz

Topics covered:

- introduction to cassette deck system operation
- understanding cassette deck circuits (preamp, motor speed control, lead adjustment etc)
- troubleshooting of a cassette deck circuit

EAV-STR-5 **Record Turntable Trainer module with 10 faults and display panel**

Type: DC servo direct drive
WOW and flutter: 0.04%
Tonearm type: dynamic balanced linear tracking
Power req.: 220Vac/50 Hz

Topics covered:

- introduction to record turntable player
- understanding of record turntable circuit and controls
- troubleshooting of a record turntable

EAV-STR-6 **Compact Disc Player Trainer module with 10 faults and display panel**

Frequency response: 100 Hz - 20 KHz
Dynamic range: 60 db
Distortion: 3%
Channel separation: 30db
S/N: 50 db
Power req.: 220Vac/50 Hz

Topics covered:

- introduction and operation of audio CD player
- characteristic of audio CD player electronic circuits
- characteristic of audio CD player laser circuits
- audio CD player troubleshooting

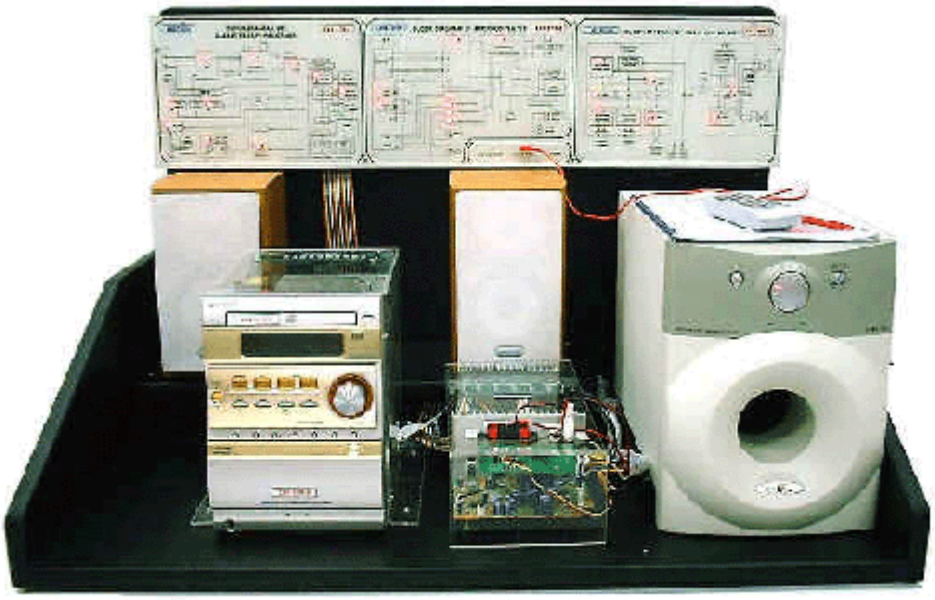
EAV-STR-7 **Microphone: 20 Hz - 13 KHz, with 2 meter cable and plug**

EAV-STR-8 **Stereo Speaker System:**

consists of 2 stereo speaker cabinets, each with a woofer, tweeter and mid-range speaker (3 speakers per cabinet) 80 Watts (music)

EAV-STR-9 **stereo headphone, complete with jack, frequency response 20 Hz - 30 KHz**

EAV2B)
Stereo Hi - Fi Trainer



ITEM : STEREO HI-FI TRAINER
MODEL : EAV-STC

The Trainer features a compact combo type Stereo Hi-Fi system that has been gaining popularity in recent years. The trainer is designed to demonstrate the principles of stereo Hi-Fi operation, theory, repair and servicing techniques for units of this type. The system is especially suited for the training of prospective audio service technicians. The trainer is based upon popular brand Hi-Fi stereo systems from famous manufacturers.

The combo type unit features an integrated Stereo System that features an amplifier, AM/FM Tuner, CD Player, Tape Cassette Player, clock Function and more. It has many features such as timers, auto on/off, programmable stations, etc. To increase the dynamics of the sound quality we have added a mega bass super woofer unit, this allows for exploration into larger sound systems.

Each module is mounted on an attractive chassis, which allows the printed circuit boards and key parts to be exposed for ease of work. All circuit boards feature Plexiglas covers, which have openings for, access to all tests points so as to allow insertion of probes while protecting the student and the circuit board. The trainer allows access to all the factory recommended Key points for the taking of measurements, analysis and adjustments. A fault insertion system has been designed into the trainer so as to allow selectable faults to be simulated one each module for student instruction purposes. The above photo shows the compact disc trainer with the fault board attached, the other modules are shown in their operational mode.

TECHNICAL SPECIFICATIONS:

Integrated Combo Stereo Hi-Fi Trainer with 30 faults Featuring the following systems:

1. **Integrated Stereo Tuner and Amplifier with 10 faults and display panel**

   Clock Function and timer
   Controls for CD, Tape and Tuner
   Inputs: AUX, Speaker
   FM Frequency Range: 88 - 108 MHz
   AM Frequency Range: 527 - 1605 kHz
   Power Req.: 220VAC/50 Hz

   Topics Covered:
   - Stereo tuner familiarization
   - Understanding stereo tuner circuit (AM and FM)
   - Combined stereo tuner and amplifier circuit
   - Troubleshooting stereo tuner and amplifier circuit

2. **Tape Cassette Deck with 10 faults and display panel**

   Type: Single cassette
   Wow and Flutter: < 0.1%
   Frequency Response :
   Normal Tape: 20 Hz - 15 kHz
   Cr02 Tape: 20 Hz - 16 kHz
   Metal Tape: 20 Hz - 17 kHz
   Dolby S/N ratio: 67 dB

   Topics Covered:
   - Introduction to cassette deck system operation
   - Understanding Cassette deck circuits (preamp, motor speed control, lead adjustment etc)
   - Troubleshooting of a cassette deck circuit

3. **Compact Disc with 10 faults and display panel**

   Frequency Response: 100 Hz - 20 kHz
   Dynamic Range: ± 60 dB
   Distortion: ± 3%
   Channel Separation: ± 30dB
   S/N: ± 50 dB

   Topics Covered:
   - Introduction and operation of Audio CD player
   - Characteristic of audio CD player electronic circuits
   - Characteristic of audio CD player laser circuits
   - Audio CD player troubleshooting

4. **Microphone: 20 Hz - 13 kHz, with 2 meter cable and plug**

5. **Stereo speaker system:**
   Consists of 2 stereo speaker cabinets 3 element, each with a woofer, tweeter and mid-range speaker (3 speakers per cabinet). Includes Separate Sub-woofer Mega Bass Speaker Unit.

6. **Stereo Headphone, complete with Jack, frequency response 20 Hz - 30 kHz**

Each trainer comes with complete courseware information as follows:

a) Factory Service Manual.
b) Student job sheets with fault guide and wiring diagram.

Note: Technical Specifications may vary somewhat depending upon the current brand and model of combo stereo Hi-Fi unit that is used in the production of the trainer.

(EAV3B)
VCD, DVD, Laser Disc, Video Camera Trainers

ITEM : VCD, DVD, LASER DISC, VIDEO CAMERA TRAINERS

The series of Audio Visual trainers for VCD, DVD, Laser disc and video camera are based upon the popular brand units, which incorporate the latest industry design features. These trainers are specifically created to teach operation, theory, repair and servicing. Special attention is given to fault diagnosis so as to facilitate the teaching of troubleshooting techniques. These trainers are ideal for use as stand alone units or can be combined with our TV trainers to make a complete Audio Visual training system.

The each unit is mounted on an attractive chassis, which allows the main printed circuit board to be exposed for ease of work. The circuit board features a plexiglass cover, which has openings for access to all test points so as to allow insertion of probes while protecting the student and the circuit board. The trainers allow access to all the factory recommended key points for the taking of measurements, analysis and adjustments.

The teaching program is designed to follow the service procedures as recommended by the manufacturer and uses the factory service manual in conjunction with student job sheets along with a text on factory servicing and theory. Each trainer comes with complete courseware as follows:

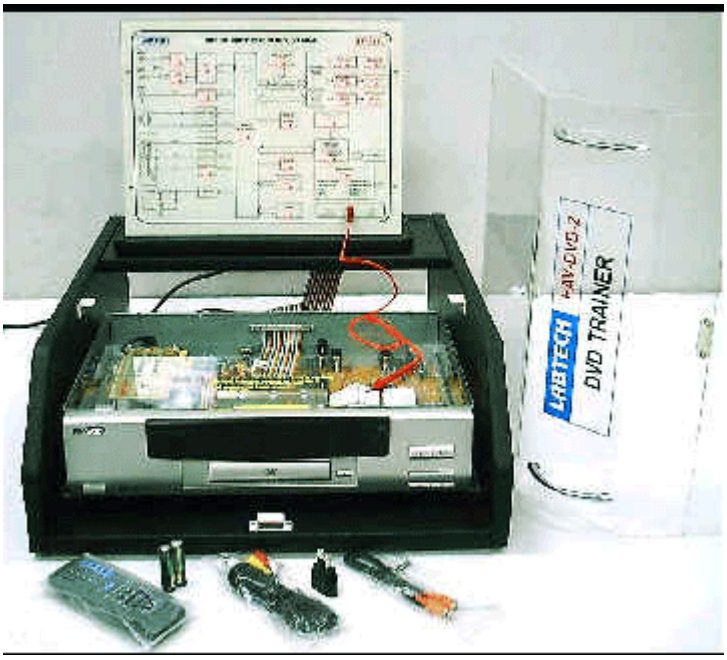
a) factory service manual with detailed circuit board schematic diagram.
b) student job sheets with fault guide and wiring diagram.
c) general book on servicing and theory.

A unique fault insertion system is built into the trainer for student instruction purposes. The system features a Schematic Block Diagram silk-screened onto an integral fault board that utilizes LEDs to indicate the nature and location of the fault.

The fault is activated by touching an electronic switch with a special teaching probe. Single or multiple faults may be introduced at any time. Fault may be visualized by use of the LED lights or the LEDs may be switched off thereby not allowing the student to know where the fault is, this feature is ideal for testing purposes.

MODELS:	**EAV-CD-2 Video Disc (VCD) Trainer (CD, VCD)** **EAV-DVD-2 DVD Trainer (CD, VCD, DVD)** **EAV-LDT-2 Laser Disc Trainer (CD, VCD, LD)** **EAV-FCU-2 Video Camera Trainer**
Fault System :	The Trainer includes an electronically selectable fault system mounted on a panel display board featuring the circuit block diagram silk-screened onto it. The faults when activated by the fault pen, illuminate an LED located within the corresponding section of the circuit block diagram. Any number of faults can be activated at the same time. A special switch control allows the teacher to disable and turn off the LED display while the faults are active. In this way faults can setup without the student knowing which faults have been activated, this is ideal for testing the students troubleshooting ability.
Circuit Board:	Solid state system incorporating integrated circuits and microprocessor chips.
Chassis :	Each unit is mounted on a special chassis, which exposes all key circuit boards and parts for ease of work. Circuit boards are protected by Plexiglas panels.
Test Points:	Test points are routed to a special PCB which groups the test points together and clearly identifies them to aid in testing and diagnostic work.
Courseware:	A) Factory Service Manual B) Student Job Sheets with fault guide and wiring diagram

(EAV3C)
DVD Trainer



ITEM : DVD TRAINER

The series of Audio Visual trainers for DVD is based upon the popular brand units, which incorporate the latest industry design features. These trainers are specifically created to teach operation, theory, repair and servicing. Special attention is given to fault diagnosis so as to facilitate the teaching of troubleshooting techniques. These trainers are ideal for use as stand alone units or can be combined with our TV trainers to make a complete Audio Visual training system. The DVD Trainer covers technology on CD, VCD and DVD systems.

The each unit is mounted on an attractive chassis, which allows the main printed circuit board to be exposed for ease of work. The circuit board features a plexiglass cover, which has openings for access to all test points so as to allow insertion of probes while protecting the student and the circuit board. The trainers allow access to all the factory recommended key points for the taking of measurements, analysis and adjustments.

The teaching program is designed to follow the service procedures as recommended by the manufacturer and uses the factory service manual in conjunction with student job sheets along with a text on factory servicing and theory. Each trainer comes with complete courseware as follows:

a) factory service manual with detailed circuit board schematic diagram.
b) student job sheets with fault guide and wiring diagram.
c) general book on servicing and theory.

A unique fault insertion system is built into the trainer for student instruction purposes. The system features a Schematic Block Diagram silk-screened onto an integral fault board that utilizes LEDs to indicate the nature and location of the fault. The fault is activated by touching an electronic switch with a special teaching probe. Single or multiple faults may be introduced at any time. Fault may be visualized by use of the LED lights or the LEDs may be switched off thereby not allowing the student to know where the fault is, this feature is ideal for testing purposes.

MODELS:	**EAV-DVD-2**	**DVD Trainer (CD, VCD, DVD)**
Fault System : 	The Trainer includes an electronically selectable fault system mounted on a panel display board featuring the circuit block diagram silk-screened onto it. The faults when activated by the fault pen, illuminate an LED located within the corresponding section of the circuit block diagram. Any number of faults can be activated at the same time. A special switch control allows the teacher to disable and turn off the LED display while the faults are active. In this way faults can setup without the student knowing which faults have been activated, this is ideal for testing the students troubleshooting ability.	
Circuit Board:	Solid state system incorporating integrated circuits and microprocessor chips.	
Chassis : 	Each unit is mounted on a special chassis, which exposes all key circuit boards and parts for ease of work. Circuit boards are protected by Plexiglas panels.	
Test Points:	Test points are routed to a special PCB which groups the test points together and clearly identifies them to aid in testing and diagnostic work.	
Courseware:	A) Factory Service Manual	
	B) Student Job Sheets with fault guide and wiring diagram	

(EAV5)
Audio Trainer

ITEM : AUDIO TRAINER

This Audio Trainer is designed to give electronics students and prospective audio service technicians skills and knowledge about basic audio systems. The trainer covers basic theory, operation and testing procedures for troubleshooting.

The trainer consists of a series of modules which consist of electrical and electronic components that are mounted onto specially designed printed circuit boards. The circuits are laid out in a logical sequence with the circuit block diagram silk screened onto the surface. Interconnections between key components or circuit blocks are provided through sockets and test leads. Components are mounted onto the circuit board and are accessible for testing and circuit analysis.

The experiment topics include: DC circuit analysis, AC circuit analysis, measurement and testing in mono modules, measurement and testing in stereo modules, audio component design, audio testing procedures and general troubleshooting procedures.

Please note that this trainer is compatible with the Labtech Radio Communications Trainer which can provide mono AM or stereo FM input signals for the audio trainer.

This trainer can also work with our Stereo Hi-Fi Trainer for signal input via the Tuner, Cassette Tape, or CD modules.

AUDIO TRAINER MODULES:

ITEM No.: EAV-ATS-00 for entire set below

Modules are Printed Circuit Boards with components mounted onto the surface and are easily accessible by the student. A silk screened block diagram on the PCB which shows the circuit diagram and the test points for easy identifications. Inter-Connections between the modules are made via 2mm, 4mm and audio style terminals and connectors. Module EAV-ATS-1 starts with the basics of audio circuit. The mono set EAV-ATS-2 covers mono audio applications. The stereo set EAV-ATS-3 goes onto stereo applications. Other modules can be used to extend the system such as the Audio Mixer (EAV-ATS-4A) or the Tape Recorder Mechanism for basic tape functions (EAV-ATS-4E) or the Sound Effects Module (EAV-ATS-4B). All the modules when combined together form a very good quality audio system (either mono or stereo) and together with the loud speakers can easily broadcast sound to the entire class. Unit comes with student and teacher manual detailing information and exercises.

EAV-ATS-R Student Base Station Rack:
This unit serve as the platform for carrying out the experiments. Experiment modules are inserted into the rack and inter-connected to form a variety of circuit functions and combinations. The boards use the power supply module to power the system (EAV-ATS-4).

EAV-ATS-1 Audio Fundamentals
Audio Amplifier Circuit Module: For Class A, B, C and AB including common-emitter, common base, common collector, multi-stage amplifiers, audio bias networks.

EAV-ATS-2 Mono Audio Systems Set (EAV-ATS-2 complete set of 4 boards)

EAV-ATS-2A	Mono 20 watt Power Amplifier Module
EAV-ATS-2B	Mono 5 watt Power Amplifier Module
EAV-ATS-2C	Mono Universal Pre-Amp Module
EAV-ATS-2D	Mono Tone Control Module

EAV-ATS-3 Stereo Audio Systems Set (EAV-ATS-3 complete set of 4 boards)

EAV-ATS-3A	Stereo 20 watt Power Amplifier Module
EAV-ATS-3B	Stereo Pre-amp Module for Pick up and head
EAV-ATS-3C	Stereo Universal Pre-amp Module
EAV-ATS-3D	Stereo Tone Control Module

EAV-ATS-4 Audio Enhancement Modules Set (EAV-ATS-4 complete set of 7 boards)

EAV-ATS-4A	Audio Mixer Circuit
EAV-ATS-4B	Sound effect module

EAV-ATS-4C Head Phone Terminal with Adjustable Output (for Stereo and Mono)
EAV-ATS-4D Microphone Pre-amp Module (for Stereo and Mono)
EAV-ATS-4E Basic audio tape recorder mechanism with tape head and erase head
EAV-ATS-4F Push-Pull Power Amplifier Module
EAV-ATS-4G Quasi-Complementary Power Amplifier Module

EAV-ATS-5 Audio Accessories Modules Set (EAV-ATS-5 complete set of 6 items)
EAV-ATS-5A Regulated DC Power Supply Module
EAV-ATS-5B Input Panel Module (for Stereo and Mono)
EAV-ATS-5C Microphone
EAV-ATS-5D Loudspeakers Set (2 units)
EAV-ATS-5E Headphones (stereo)
EAV-ATS-5F Dummy Load Module: 8 Ohm and 4 Ohm

(EAV6)
Tape Recorder Trainer

ITEM : TAPE RECORDER TRAINER
MODEL : EAV-TRR-1

The Audio Equipment Trainers are based upon the popular brand solid state tape recorders which incorporate the latest industry design features. These trainers are specifically created to teach tape recorder operation, theory, repair and servicing. Special attention is given to fault diagnosis so as to facilitate the teaching of troubleshooting techniques. These trainers are ideal for use as stand alone units or can be combined with our other audio trainers to make a complete stereo training system.

The tape recorder is mounted on an attractive chassis which allows the main printed circuit board to be exposed for ease of work. The circuit board features a plexiglass cover which has opening for access to all test points so as to allow insertion of probes while protecting the student and the circuit board. The cassette mechanism is mounted in its original case which has been modified so as to allow the mechanical parts to be easily accessible for student work. The trainer allows access to all the factory recommended key points for the taking of measurements, analysis and adjustments. All controls are functional just as on an actual cassette recorder/player.

The teaching program is designed to follow the service procedures as recommended by the manufacturer and uses the factory service manual in conjunction with student job sheets, along with a text on audio equipment servicing and theory. Each trainer comes with complete courseware information as follows:

a) factory service manual with detailed circuit board schematic diagram.
b) student job sheets with fault guide and writing diagram.
c) general book on audio equipment servicing and theory.

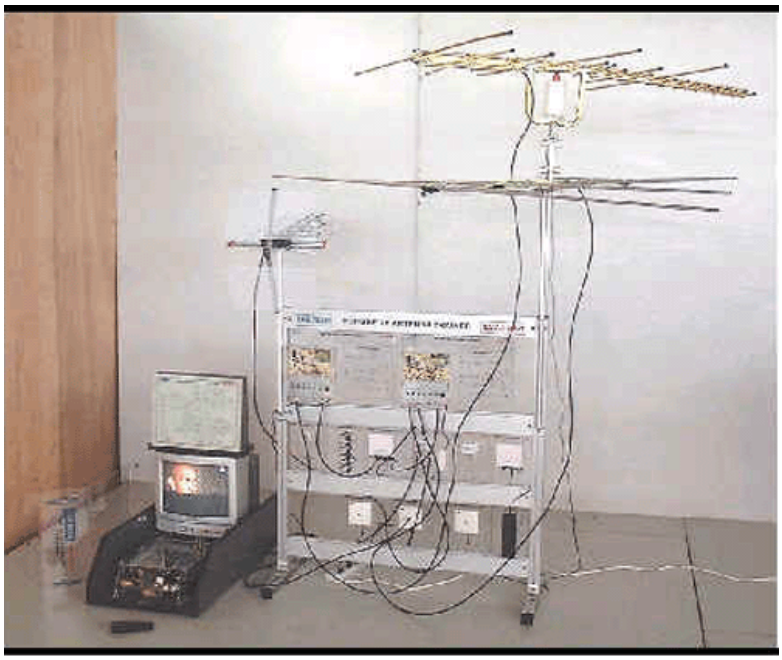
A unique fault insertion system is built into the trainer for student instruction purposes. The system features a Schematic Block Diagram silk screened onto an integral fault board that utilizes LEDs to indicate the nature and location of the fault. The fault is activated by touching an electronic switch with a special teaching probe. Single or multiple faults may be introduced at any time. Faults may be visualized by use of the LED lights or the LEDs may be switched off, thereby not allowing the student to know where the fault is. This feature is ideal for testing purposes.

SPECIFICATIONS:	**TAPE RECORDER TRAINER**
MODEL NO.:	**EAV-TRR-1**

Tape Recorder/Player	Cassette Tape, Manual
Amplifier	5 Watt
Tape Speed	1.7/8 inch/sec (ips) - 4.76 cm/sec (cps)
Response	150 Hz to 6000 Hz
Wow and Flutter	< 0.5%
Signal/Noise Ratio	> 30 dB
Sensitivity	< 2m V/m
Inputs	Microphone, Remote Pause, Auxiliary
Output	Speaker, Headphone Jack
Features	Auto stop, Tape revolution counter, Record, Playback, Fast forward, Rewind, Volume control, Tone control, Radio tuner
Microphone	Built-in Electric / Condenser Microphone

Power	220 V/50 Hz/1 Phase
	110 V/60 Hz/1 Phase
Fault system	20 Fault Insertion System
	Electronically selectable faults for troubleshooting analysis. Fault location is illuminated on the fault panel by LED indicators. Fault panel is silk-screened with the basic circuit schematic block diagram.
Chassis	Tape Recorder is mounted on a special chassis which exposes all key circuit boards and parts for ease of work. Circuit boards are protected by plexiglass panels which have test probe holes to allow access for measurement tests.
Courseware	a) Factory service manual
	b) Student job sheets, fault guide, wiring diagram
	c) General book on audio equipment servicing and theory

(EAV7)
TV Antenna Trainer



ITEM : TV ANTENNA TRAINER

In today's world of electronics communication the television is becoming an increasingly versatile tool for the reception. No longer is television reception a simple matter but grows more complex each year.

The TV Antenna trainer teaches students about the many aspects of TV reception and signal distribution. It will familiarize students with the various types of antennas in common use and demonstrate a number of methods of signal distribution in common practice today.

The unit is designed to work with and complement the wide range of Labtech Training Systems for Audio-Visual Communications. It is ideally suited to match with our Television trainers, VCR trainers, Laser Disc trainers and Color TV Transmitter trainer. Each of our trainers may be used alone but also combine to make a complex system which enables enhanced training.

The above photo shows the TV Antenna trainer model EAV-TVA-1 together with the Labtech TV Trainer EAV-TVT-C2 (optional) which must be ordered separately.

Technical Specification:

The trainer is designed in a modular format which can accept a variety of antennas, signal conditioning and distribution modules. The modules mount our Rack Mount Panel System which provides a superior presentation to the student and allows ease of use for quick connections. A variety of experiments and circuits can be connected by utilizing the panels in selected configurations. Connections are quickly made via the cabling system. Connections are made via 4mm, 2mm and coaxial terminals.

Rack Frame : 4 tier frame made of extruded aluminum and steel.

MODEL: EAV-TVA-1 STANDARD TV ANTENNA TRAINER
Hardware and Modules:

1 UHF Antenna, 1 VHF Antenna,
1 UHF/VHF antenna with electric rotation device
Mixer with 2 UHF and 2 VHF inputs
Set of 2 preamplifiers
broad band amplifier
UHF Pre-amplifier
VHF amplifier with AGC
UHF amplifier with AGC
broad band power amplifier
UHF equalizer filter
UHF / VHF channel converter
Set of signal dividers, splitters, directional and
resistive outlets, 75 Ohms loads.
Power Supply
Set of cables for interconnection.

Course Contents:

Characteristics and operation of antennas and antenna elements.
Characteristics and operation of signal distribution.
TV signal mixers, amplifiers, filters, converters,
power supplies, cables, coaxial splitters, modulators.
Combined signal distribution systems for TV, VCR, & Satellite signals.

Chain Distribution network and node distribution network.
Measurement of cable attenuation.
Individual broad-band system.
Use of equalizer filter with channel amplifier; multiple channel with channel amplifier.

MODEL: EAV-TVA-2 ADVANCED MATV/ SMATV/ CATV ANTENNA AND DISTRIBUTION TRAINER

The Universal Antenna trainer for MATV (Master Antenna Television), SMATV (Satellite Master Antenna Television) and CATV (Cable Television) system is designed for study and training on installations. The user is able to calculate, install, configure, adjust, alter, analyze and localize breakdowns in distribution networking using:

- Terrestrial television (MATV)
- Analogue and digital satellite television (SMATV)
- Cable television (CATV)

The work book presents practical exercises designed to facilitate the learning process. The exercises have the aim of calculating and performing measurements on different types of installation and localizing the more common problem which the student will come across in future installations

Antennas:

27 element UHF antenna (Channels 21-69)
90 cm centered focus parabolic antenna containing:
- Reflector
- Double LNB (H and V) (Power adapter included)
- Accessories: Rods and Power Accessories.

Mechanical Accessories:

- 150 cm mast for terrestrial antenna
- 80 cm mast for parabolic antenna
- Mobile stand for antenna with wheels

Parabolic Antenna Motor:

- Motorized arm for aiming parabolic antenna

Head End Equipment – MATV

a. MATV:
- Set of 8 programmable UHF amplifiers
- VHF amplifiers
- Power supply

b. SMATV (analogue and digital) for RF:
- Programmable IF-UHF (stereo) internal units
- Universal Programmer
- Power supply for internal units

c. SMATV (analogue and digital) for IF:
- Adjustable IF amplifier (x4) with terrestrial signal mixing and amplification
- Power supplies for LNBs and IF amplifiers

Collective and individual MATV Distribution:

- Splitters/ Combiners
- Taps
- Through outlets and end outlets
- Splitter outlets

Collective and individual SMATV Distribution (analogue and digital) by Intermediate Frequency:

- IF Splitters
- H and V commutable IF splitters
- IF outlets

Collective CATV Distribution:

- CATV line amplifier with attenuator, equalizer and pre-emphasiser.
- Active return channel with gain control.

User equipment:

- Tuner-receiver and antenna positioner
- Remote control

Mini-Satellite and Receiver and LNB Tester Accessories for aiming antennas:

- Inclinometer
- Compass

Accessories and Cables:

- Roll of coaxial cable
- 6 – conductor cable
- Markers for the white board
- Load adapters
- Bridges
- Polarizing Connector

Documentation:

- Instruction Manual
- Practice Manual.

(EAV8)
Satellite TVRO System Trainer

ITEM : SATELLITE TVRO SYSTEM TRAINER
MODEL : EAV-SAT-1 Analog Satellite Trainer with TV
EAV-SAT-2 Analog Satellite Trainer with TV and Computer
EAV-SAT-3 Digital Satellite Trainer with TV
EAV-SAT-4 Digital Satellite Trainer with TV and Computer

This is a complete system for the training in the theory, operation, installation, maintenance, troubleshooting and repair of satellite TVRO system. This trainer is especially designed for the Asian market where the reception of TV signals from the numerous satellites is becoming popular in many countries. Students that use this training system will be able to understand how these systems work and train to become a satellite TVRO technician or engineer. We have both Analog systems which are still in common use as well as the newer Digital systems.

The EAV-SAT-1 and 3 trainer is built around a typical high power advanced satellite receiving station that can receive all the satellites that broadcast TVRO in the Asia area. It consists of a typical TVRO system that has been specially modified for training. The EAV-SAT-2 and 4 also have an interface to a computer for analysis purposes.

The package for the EAV-SAT-1 and 3 includes everything that is required for TVRO: the Parabolic dish, dish position actuator, dish position control, feedhorn, low noise amplifier, down converter, tuner coaxial cable, television unit. The EAV-SAT-2 and 4 also included is a PC computer with special satellite analysis and dish aiming software. In addition a number of

text books are provided which informs the students about all the technician details of the system. Job sheets enable the students to go through a systematic exploration of the TVRO system.

TECHNICAL SPECIFICATIONS:

PARABOLIC DISH: 3 meters, for interception and receiving the satellite signal.

DISH MOUNT SYSTEM: Small tower/stand for the mounting of the dish and to provide a stable and controlled platform for the drive system.

DISH POSITION ACTUATOR: The dish position actuator is an electronically controlled drive system that accurately allows the dish to be positioned for the reception of specific satellites. Drive is provided on one axis only.

FEEDHORN: To receive the signal from the parabolic dish. Unit provided is a low noise feedhorn that also allows for the selection and fine tuning of signal polarity.

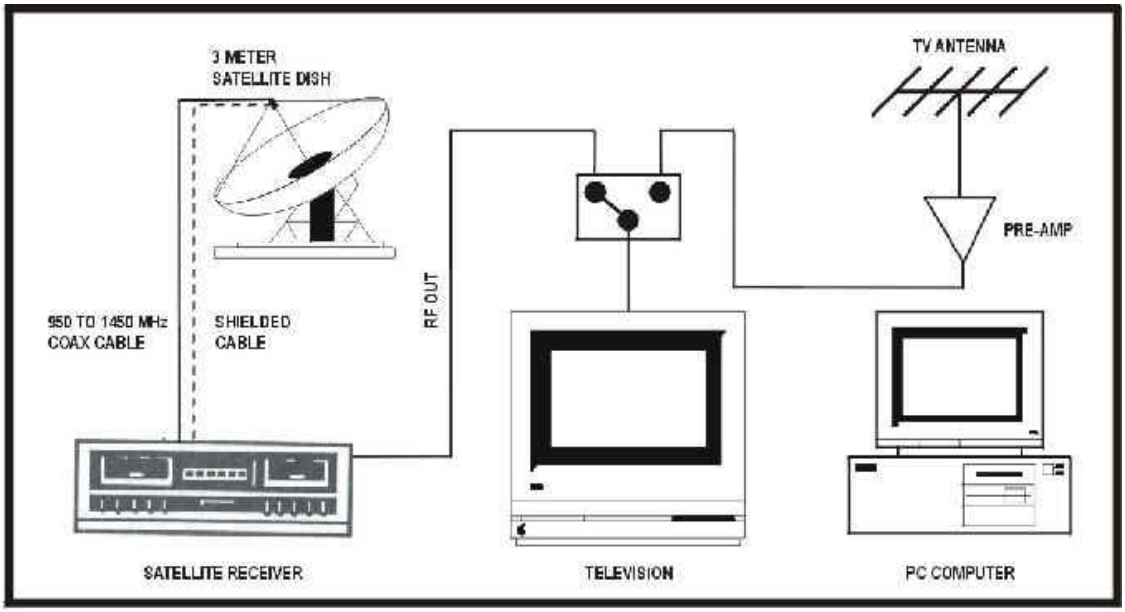
LOW NOISE AMPLIFIER: The Low noise amplifier detects the microwaves relayed from the feedhorn and converter them to electrical signals and amplifies them.

DOWNCONVERTER: After amplification, the signal is processed by the down converter and it translates either all of part of the signal to a lower frequency range which is ready for TV reception.

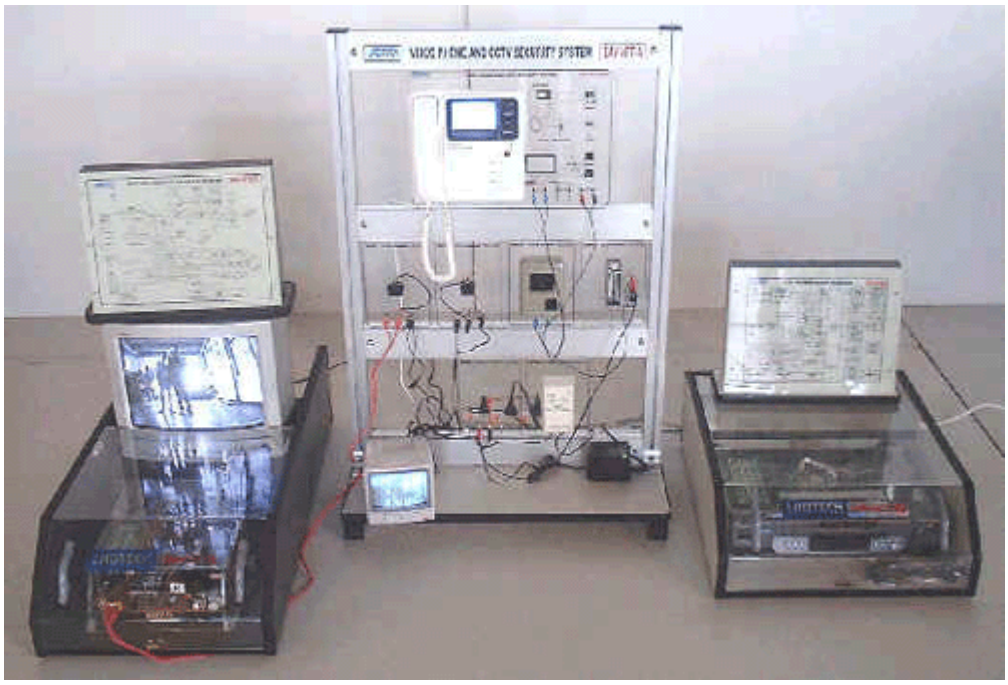
TUNER: The tuner allows for individual satellites and stations on each satellite to be stored into memory. This facilitates switching between preprogrammed channels on the various satellites. Unit also controls the dish position actuator so that the dish can be pointed to the correct location for best reception.

COMPUTER ANALYSIS SYSTEM: Consists of a PC computer and printer with special satellite aiming and analysis software. Software provides many features that are valuable for the learning process including TVRO system analysis, antenna aiming function and it can demonstrate how changing parameters such as dish size or LNB noise temperature affect picture quality. Analysis portion allows either English or metric measurements to be used.

COURSEWARE: The trainer comes with job sheets to lead the student through the course basics and also includes many texts books and guides that include additional information and exercises.



(EAV9)
Video Phone & CCTV Security



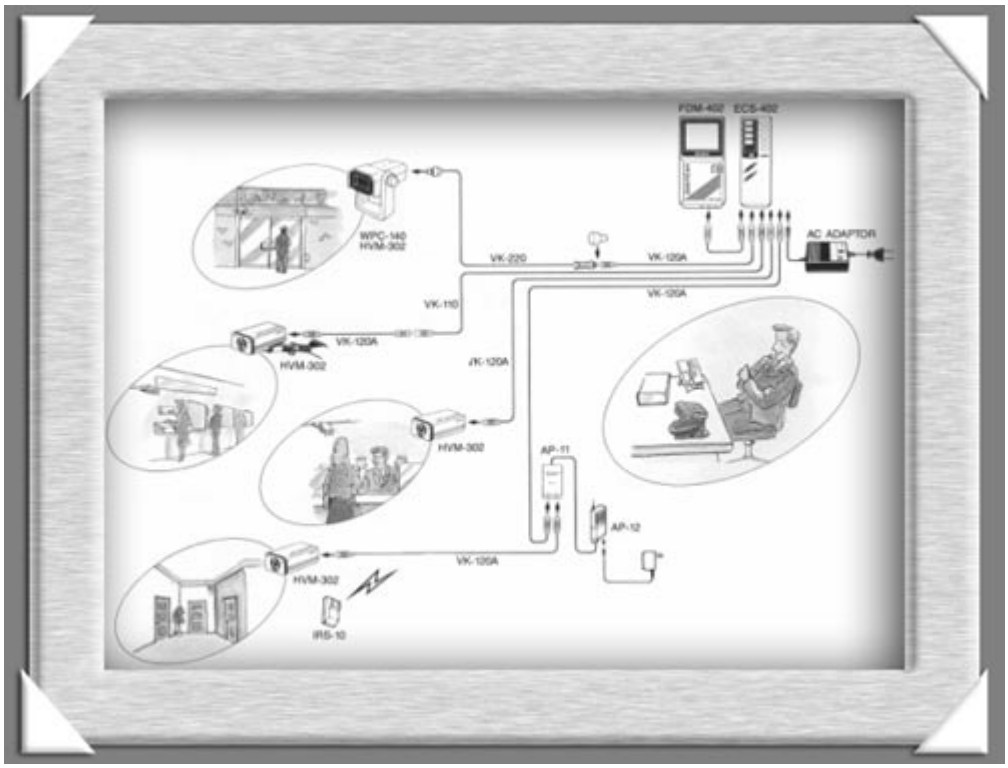
ITEM : VIDEO PHONE AND CCTV SECURITY SYSTEMS

We are offers several configurations of Video Phone and CCTV Security Systems. These are designed to train students in domestic and commercial applications of these systems. In the program the students will learn about the system components, their use, placement of cameras and sensors, wiring and operation of the systems along with basic troubleshooting.

All components are fixed to our panel mount frame system. A three level panel frame is included so those components can be easily placed on the frame in various configurations and then connected together to form working systems. This makes wiring and experimentation very fast and easy for the student. Manuals are included for student experiments.

EAV-VPT-A: Video Phone Trainer. Video Phone are gaining popularity as means of internal building communications and also for guarding or securing entry/exit to premises both in residential and commercial applications. The system includes cameras plus intercom units, master TV Monitor plus intercom and an electronic door lock. All units are mounted on panels with connection terminals. A three level frame is included.

Note: Photo above shows Video Trainer with optional TV Trainer and VCR Trainer



CCTV Trainers: CCTV Systems are now commonly used to supplement security systems. We offer two types of systems as usually used in commercial applications. They are useful for detecting and monitoring unauthorized personnel and recording their movements. Several different types of cameras included so the student may become familiar with their operation and placement. Sensors are included for the

detection of movement which will then activate the camera. The multiple camera switches will allow both manual and automatic selection of the camera to be viewed on the monitor or recorded on the VCR.

EAV-CCT: Basic System. This basic system has features similar to small commercial applications which is normally used as an augment to a security guard station. The system consists of 4 cameras (of 3 different types), infra-red motion detector, remote On/Off switch, TV Monitor, Multiple camera switcher plus cabling and accessories. All components are mounted onto panels with connection terminals. A three level frame is included.

EAV-CCT-X: System with VCR. This is a more complex system with recording facilities. The system includes 4 cameras (of 3 different types), infrared motion detector, remote on/off switch, TV monitor, multiple camera switcher, security type VCR with long playing tape facility, plus cabling and accessories. All components are mounted onto panels with connection terminals. A three level frame is included.

Note: These systems can integrate with Labtech TV and VCR Trainers to increase experimentation capabilities (See catalog pages EAV1A and EAV3A)

(EAV10)
PABX and Intercom Trainer

Item : PABX and Intercom Trainer

When Alexander Graham Bell filed his application for a telephone patent on February 14, 1876. The apparatus he invented was extremely simple, it consisted of an electromagnetic transmitter and electromagnetic receiver connected together with a battery, and produced sounds. Many improvements have been made since then and today's telephones are very different in size and inside components as compared with Alexander Graham Bell's telephone. The telephone has become indispensable in providing communication between many different locations.

Labtech has developed several realistic trainers to teach students about theory, operation, and installation of telephone/intercom systems. The EAV-ITT-1 is an intercom system of the type that is commonly used to provide communications between rooms and offices, or in a house, or in large company locations. The EAV-ITT-2 is a modern PABX system that has many features as used by small and large businesses. Both trainers will give the students the knowledge and practical aspects of these system which will help them understand the technology and it's applications.

The trainers feature real telephone and intercom products that have been specially modified for training. The systems are fully operational and modular in nature a set of experiments is designed to cover the theory, use, set up and installation practices in a comprehensive experiment manual to guide the students understanding the system. All components are mounted onto the Labtech panel type training format which features transparent plexiglass modular panels which are mounted onto a rack system.

General Specifications EAV-ITT-1 Intercom Trainer:

The trainer is a panel system containing six channel intercom system complete with the power supply and all cord connections. The set includes

- master control for 6 stations (1 unit)
- individual stations (6 units)
- power supply unit for system (1 unit)
- door unit with lock (3 units)
- 3 level bench top installation frame (1 unit)

Technical Specifications :

- 6 master can be connected to a master
- up to 3 door units can be connected.
  (when door unit is used, maximum composition is 4 masters and 3 door units.
- three different call signals for door units
- master unit is provided with an electrical door opener switch
- one common speech channel
- call transfer of a door unit call

Accessories :

- one labtech experiment manual
- one operation manual from manufacturer
- one set of connections test leads

General Specifications EAV-ITT-2 PABX Telephone Trainer:

the trainer is a panel system containing PABX telephone system with many modern programmable features and comes complete with the power supply and all cord connections. the set includes

- PABX central control panel (1 unit)
- central operator control station with LCD display (unit)
- executive telephone with special features (2 units)
- normal system telephone (2units)
- standard telephone (2 units)
- door unit with lock (1 unit)
- 3 level bench top installation frame (1 unit)

Technical Specifications :

- capacity: incoming line (2), extensions 6, 2 intercom paths
- control method: stored program CPU, 8 bits CPU, control ROM 64kb, control RAM 8 kb
- switching method: space division CMOS crosspoint
- power supplies: AC 110-240V, 50/60 Hz
- dialing: pulse and tone

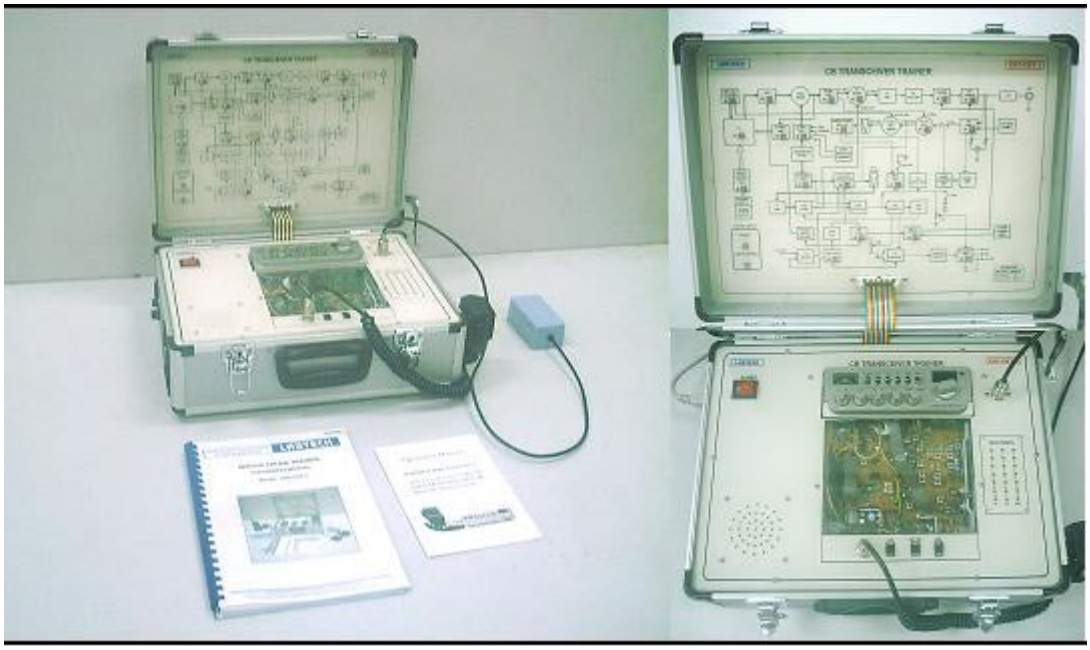
Accessories :

- one Labtech experiment manual
- one operation manual from manufacturer
- one set of connections test leads

Note : slight specification changes might occur to components or system features, depending upon brand of product that is used for the trainer.

(ERT1)

cB transceiver trainer



item : cB transceiver trainer
model : ERT-CBT-1 CB transceiver trainer
eRT-CBT-2 lED fault display panel

The citizens band (CB) transceiver trainer is designed to familiarize students with the operation, maintenance, adjustment and repair of CB units. The trainer consists of CB unit which has been mounted in a special chassis with all key internal parts exposed. All controls are functional just as on an actual CB and test points are available for the student to make measurements and tests directly without opening the case. A unique electronic fault insertion system is built into the trainer for student instruction purposes. The fault is activated by touching an electronic switch with a special teaching probe. single or multiple faults may be introduced at any time. Faults may be visualized by use of the optional led fault display board which features a schematic of the circuit block diagram silk-screened onto the display panel that incorporates LEDs to show the location of the faults. LEDs may be switched off, thereby not allowing the student to know where the fault is. This feature is ideal for testing purposes:

General Features:

- powerful yet compact CB transceiver
- built in test points are available to the student
- built in speaker to monitor communications
- hand microphone for voice transmission
- 5 modes operation: CW, AM, FM, LSB, USB (switch selectable)
- full noise reduction
- TX illuminated lamp which indicates system is "on the air"
- electronic fault simulation
- theory notes and experiment sheets for 20 lessons
- 25 transparency sheets
- factory service manual and circuit diagram

technical specifications:

model : eRT-CBT-1	**cB transceiver trainer**
frequency range	26 to 30 MHz in 4 steps
channel	200
frequency space	10 KHz (minimum 50db)
emission bands	CW/AM/FM/LSB/USB (selectable with rotary switch)
power	13.8 Vdc; 110 - 220 Vac 50 Hz, 4 Watt
receiver sensitivity	AM 1 micro v20 db s/n FM 1 micro v20 db s/n SSB/CW 0.5 micro v20 db s/n
selectivity	50 db
audio out	2 w/8 ohm
Fine tune range	+/- 800 Hz
coarse time range	+/- 5 KHz
squelch range	60 db at 500 mW output 40 db at 500.5 KHz
IF/FM/AM SSB/CW	10.6905 MHz/455 KHz 20.695 MHz
transmitter rF power output (switchable	SSB/CW : 12 W, 8 W, 2 W

in 3 ways, low/mid/high)	AM : 7.5 W, 4 W, 1 W FM : 10 W, 7 W, 2W
sSB generator	double balanced with crystallite filter
coarse tune range	+/- 5 KHz
accessories	dummy load 35 W

courseware available in bahasa indonesia or English

(ERT2)
AM & FM Radio Trainer

ITEM : AM & FM Superheterodyne Radio Trainer
MODEL : ERT-AFS

This compact trainer is designed to teach overall theory and operation of AM & FM radios as well as covering advanced points concerning testing and troubleshooting in radio engineering.

The trainer consists of complete operational circuits for an AM superheterodyne receiver as well as an FM superheterodyne receiver which have been mounted onto easily accessible printed circuit boards. The circuits are logically laid out and feature the circuit block schematic diagram printed onto the surface of the board identifying functions, components and numbered test points. Components including adjustable

trim pots, tuning controls, and removable ICS are mounted on top of the boards to allow students access to them.

A special electronic fault insertion system is built into the trainer for student instruction purposes. The fault is activated by touching an electronic switch with a fault teaching probe. Single or multiple faults may be introduced at any time. Trainer includes comprehensive manuals and experiment sheets.

Technical Specifications:

mw:	510 to 1625 KHz (AM) if 455 KHz
vHF:	87.5 to 108 MHz (FM) if 10.7 MHz
selectivity:	50/60 db (AM/FM)
output:	2 x 14/20 W (normal peak output) with 4 Ohm
transmission range:	20 Hz to 20 KHz
treble/bass control:	+12 db/10khz/100KHz
distortion voltage:	220 v 50/60 Hz
fault system:	20 electronically selectable faults
controls:	mode (AM/FM) volume control bass control treble control

Output connection jack to external speaker
External power requirements: 220V AC/1ph/50Hz

All PCB boards are high quality fiberglass circuit boards coated with epoxy to give a long life and resist corrosion. Components are mounted on the surface and the circuit diagram is silk-screened onto the PCB to aid in the understanding of the function of the circuit.

Courseware includes manual and experiment sheets for students and teachers featuring:

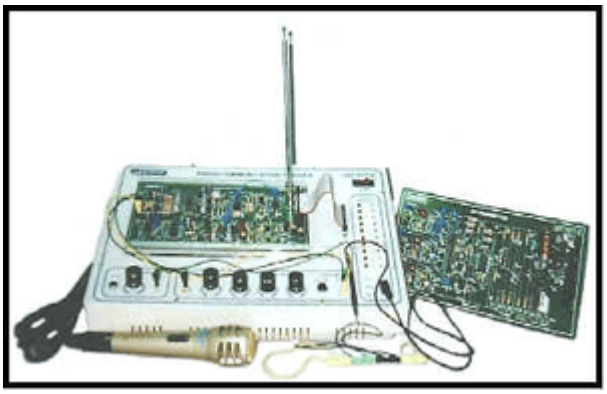
AM receiver techniques:	AM RF stage, AM mixing stage, AM/IF amplifier, RF tuning circuit
AM module:	transistor superheterodyne single band AM receiver on a single PCB. unit features complete functioning circuit including antenna coil, local oscillator, RF amplifier, IF amplifier, diode detector, audio amplifier, power amplifier with volume and tone controls.
FM receiver techniques:	AM RF stage, FM mixing stage FM oscillator, PPL synthesizer, FM filter, FM/IF amplifier, FM demodulator, PLL stereo decoder, RF measuring techniques.
FM module:	FM stereo IC single band receiver. features complete functioning circuit including the following systems, mixer stage alignment and

testing, if amplifier alignment and testing, pre-emphasis & de-emphasis circuit alignment and testing cross over frequency network for loud speaker, volume and tone controls.

model ERT-AFS-1:	Trainer with one AM module and one FM module (without faults).
model ERT-AFS-2:	Trainer with AM module only (without faults).
model ERT-AFS-1F:	Trainer with 20 electronic faults (10 per module).
model ERT-AFS-2F:	Trainer with AM module plus 10 electronic faults.
model ERT-AFS-3:	Trainer with FM module only (without faults).
model ERT-AFS-3F:	Trainer with FM module plus 10 electronic faults.

(ERT3)
radio communications

Item : radio communications training system



This trainer consists of modular based program designed for the study of radio communication. The entire system takes the student from basic RF principles to advanced concepts in an organized and methodical way.

Each module covers a particular receiving or transmission technology and consists of a special board onto which the circuit components are mounted so as to be easily accessible to the students. Modules consist of a high quality epoxy coated fiberglass printed circuit board (PCB) with the components mounted onto the surface. On each board the components are laid out in a clear and logical manner and the circuit schematic diagram is silk-screened onto the surface. This aids the student in component identification and explanation of the circuit function. Test points are featured in appropriate places and are numbered for reference in the exercises. 10 fault circuits are built into each module and can be activated through the electronic fault insertion system included on the base station. Each module comes with it's own hardware and courseware that provides theory as well as practical exercises for students.

Modules are mounted into a base

station during operation. The base station features common controls, power supply and an electronic fault insertion system that is required for operation of the module. The fault insertion system is activated by touching an electronic switch with a special teaching probe. Single or multiple faults may be introduced at any time.

model 1: ERT-RCT-1 base station unit module

Hardware: The base station is designed to support the modules during use. Modules plug into the base station to enable operation. Base station has the following features:

- rail to insert the modules with connection socket
- power supply and amp circuits to operates the receiver & transmitter modules
- electronic fault insertion system for exercises in trouble-shooting with 10 faults, 10 LED indicators, fault pen, reset button. system can also disable fault led display for testing purposes.
- microphone pre-amp with microphone output jack and volume control.
- tone control circuit with controls for volume, bass, trebles and balances.
- power amplifier with output for headphones and speakers
- two potentiometers for use with the modules.
- on/off switch and indicator lamp.
- built-in small mono speaker.

module 2: ERT-RCT-2 AM receiver

Hardware consists of a printed circuit board mounted with the electronic components for a typical AM (amplitude modulated) superheterodyne receiver. Unit has test points conveniently located on the

module 6: ERT-RCT-6 AM transmitter

Hardware consists of a printed circuit board mounted with the electronic components for a typical AM (amplitude modulated) superheterodyne transmitter. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation. AM transmitter has multiband capability for MW/SW1/SW2.

Topics and Experiments: basic AM transmitter principles; transmitter amplitude modulation; RF carrier concepts; beat frequency principles; varactor diode; automatic frequency control in transmitters; transmitting antenna resonance & impedance; servicing and troubleshooting.

module 7: ERT-RCT-7 FM transmitter

Hardware consists of a printed circuit board mounted with the electronic components for a typical FM (frequency modulated) superheterodyne transmitter. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation.

Topics and Experiments: FM transmission principles; FM stereo multiplex transmission; suppressed carrier transmission; frequency modulation; FM transmitter circuits;

surface of the board to facilitate testing and experimentation.
Topics and Experiments: basic AM receiver principles, demodulation; amplifiers (audio, IF, RF, coupling); RF tuners; RF detectors and AVC; discriminators & limiters; RF mixers & converters; local oscillator; AM receiver alignment; filters & impedance matching; amplitude modulation; AM stereo concepts; antenna & impedance matching; tone control; beat frequency concepts; automatic frequency & gain control in receivers; servicing and troubleshooting.

module 3: ERT-RCT-3 FM stereo receiver
Hardware: consists of a printed circuit board mounted with the electronic components for a typical FM (frequency modulated) superheterodyne receiver. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation.
Topics and Experiments: basic FM receiver principles, frequency modulation; frequency deviation, FM sideband; FM detection principles; RF amplifier; RF mixer; FM tuner; if amplifier & limiter; FM stereo principles; FM stereo demodulation; tone control; balance control; volume control; stereo audio amplifier; FM stereo receiver alignment; servicing and troubleshooting.

Module 4: ERT-RCT-4 DSB Receiver
Hardware consists of a printed circuit board mounted with the electronic components for a typical DSB (double side band modulation) receiver. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation.
Topics and Experiments: DSB principles; DSB reception and signal demodulation; detector, differences and similiarities with AM; servicing and troubleshooting.

servicing and troubleshooting.

module 8: ERT-RCT-8 DSB transmitter
Hardware consists of a printed circuit board mounted with the electronic components for a typical DSB (double side band modulated) transmitter. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation.
Topics and Experiments: DSB principles (carrier and sideband); DSB transmission principles; generating of DSB signal; servicing and troubleshooting.

module 9: ERT-RCT-9 SSB transmitter
Hardware consists of a printed circuit board mounted with the electronic components for a typical SSB (single side band modulated) transmitter. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation.
Topics and Experiments: carrier and sideband principles; SSB transmission principles; generation of SSB signals; filtering method; sideband selection; servicing and troubleshooting.

Module 10: ERT-RCT-10 stereo speaker system
Hardware: general purpose stereo speaker set mounted in enclosures. Two units are provided for stereo experiments. speakers are designed for operation with the above training systems.
Topics and Experiments: for use with the above training systems to facilitate audio output, speaker impedance and concepts of matching to audio systems

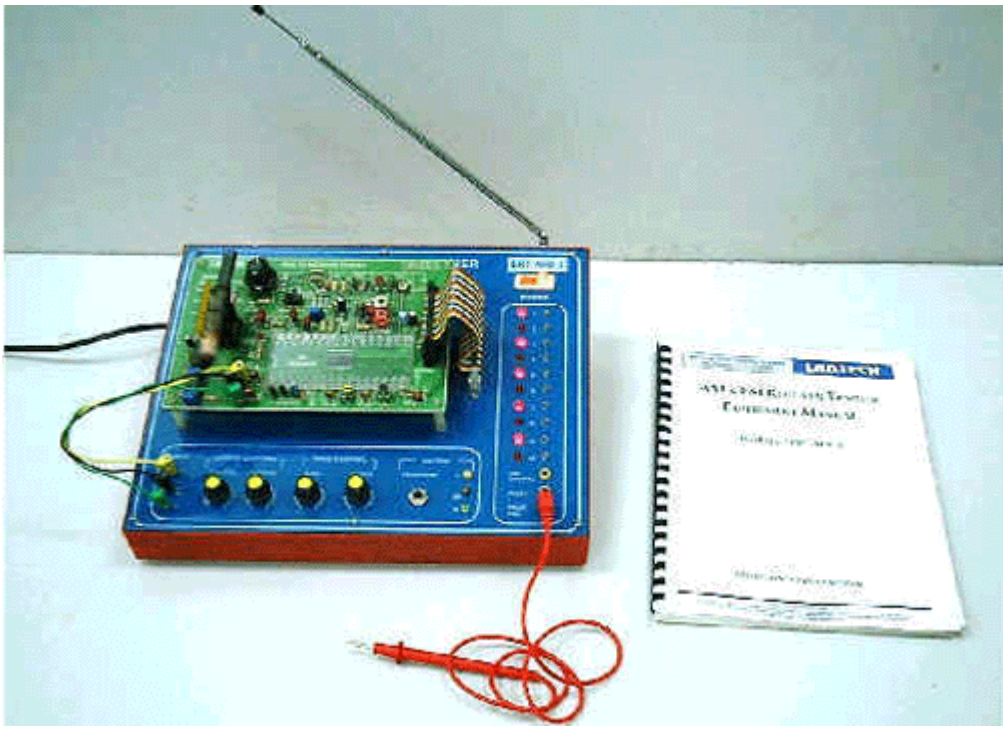
Module 11: ERT-RCT-11 Microphone
Hardware: a general purpose hand held microphone, which may be used in conjunction with transmitters as a signal source.

Module 5: ERT-RCT-5 SSB Receiver
Hardware consists of a printed circuit board mounted with the electronic components for a typical SSB (single side band modulation) receiver. Unit has test points conveniently located on the surface of the board to facilitate testing and experimentation.
Topics and Experiments: carrier and sideband principles; SSB receiver principles; SSB reception and signal demodulation (BFO tuning, frequency error and sideband selector); servicing and troubleshooting.

Module 12: ERT-RCT-12 stereo headphones
Hardware: these can be used in place of the speakers in order to enable the student to conduct the experiments quietly.

module 13: ERT-RCT-00 complete trainer set
A complete set of the above equipment including the base station unit, 8 radio receiver/or transmitter models, stereo speaker system, microphone and stereo headphones

(ERT4)
integrated AM & FM radio trainer



Item : integrated aM & fM radio trainer
Model : ERT-AFS-4

This compact trainer is designed to teach overall theory and operation of a modern design integrated AM & FM radio as well as covering advanced points concerning testing and troubleshooting in radio engineering.

It features a single printed circuit board that combines the functions for both AM and stereo FM into a single circuit. This design is incorporates up-to-date technology and is similar to those found in modern automotive AM/FM radios. The circuit is logically laid out and features the circuit schematic diagram printed onto the surface of the board identifying functions, components and numbered test points. All components are mounted on top of the boards to allow students access to them.

A special electronic fault insertion system is built into the trainer for student instruction purposes. Touching an electronic switch with a fault teaching probe activates the fault. up to 10 single or multiple faults may be introduced at any time. Trainer includes comprehensive manuals and experiment sheets.

technical specifications:

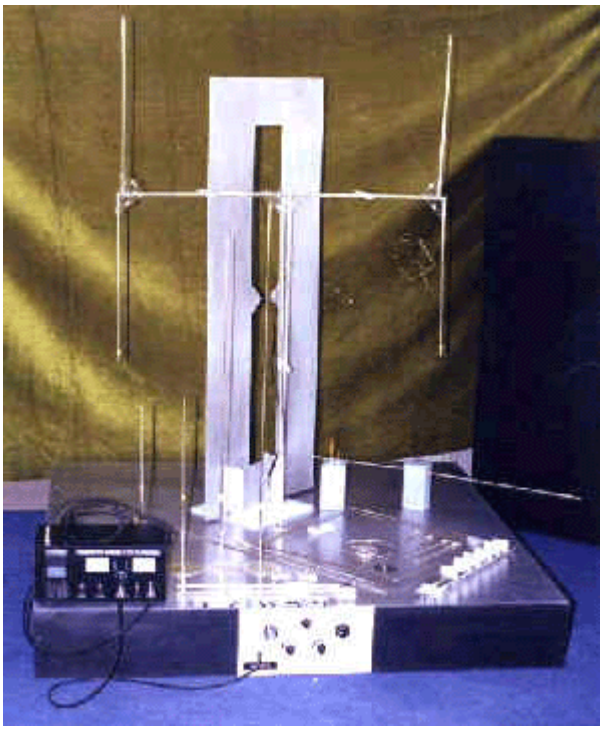
integrated AM & FM radio trainer (ERT-AFS-4)

mW (AM):	510 to 1625 KHz (AM) 455 KHz
vHF (FM):	87.5 to 108 MHz (FM) if 10.7 MHz (stereo)
audio frequency	20 Hz to 20 KHz
(FM):	+12 db/10 KHz/100 KHz
treble/bass control:	LED display
tuner indication:	LED
stereo signal	LED
indicator:	10 electronically selectable faults
signal strength	mode (AM/FM)
indicator:	volume control
fault system:	bass control
controls:	treble control

Output connection jack to external speakers
External power requirements: 220V AC/1 ph/50 Hz

Courseware includes manual covering theory and practical student exercises.

(ERT6)
antenna system demonstrator



item : antenna system demonstrator
model : ERT-ASD

Antennas have a very important function in communication. It sends energy from a transmitter into space or absorbs it from a passing wave for a receiver. The varieties and configurations of antennas have a great influence on how well communications systems will operate. This makes the study of antennas an essential part of any communications course.

Operational antennas are built for a wide range of shape and size depending on their operating frequencies and functions. The Labtech antenna demonstrator is designed to work on 167.2 MHz frequencies, which makes the antenna size suitable for a classroom demonstration. This antenna demonstrator will help students in understanding antenna principles and practice. It allows the student to do qualitative assessment of voltage and current fields distribution around the antenna and the field strength of the radiated signal at a distance from the antenna.

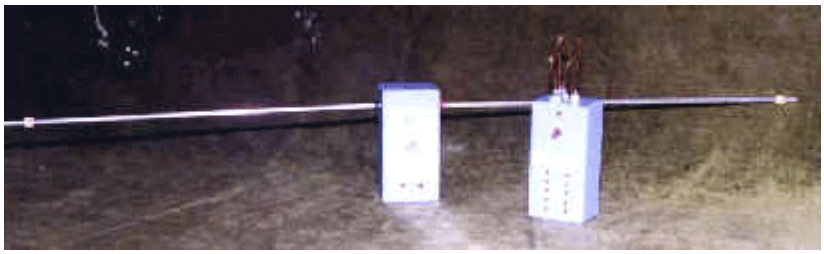
The antenna system demonstrator comes complete with a comprehensive student experiment manual to give a step-by-step guide in exploring the antenna in both theory and practice.

Specification:

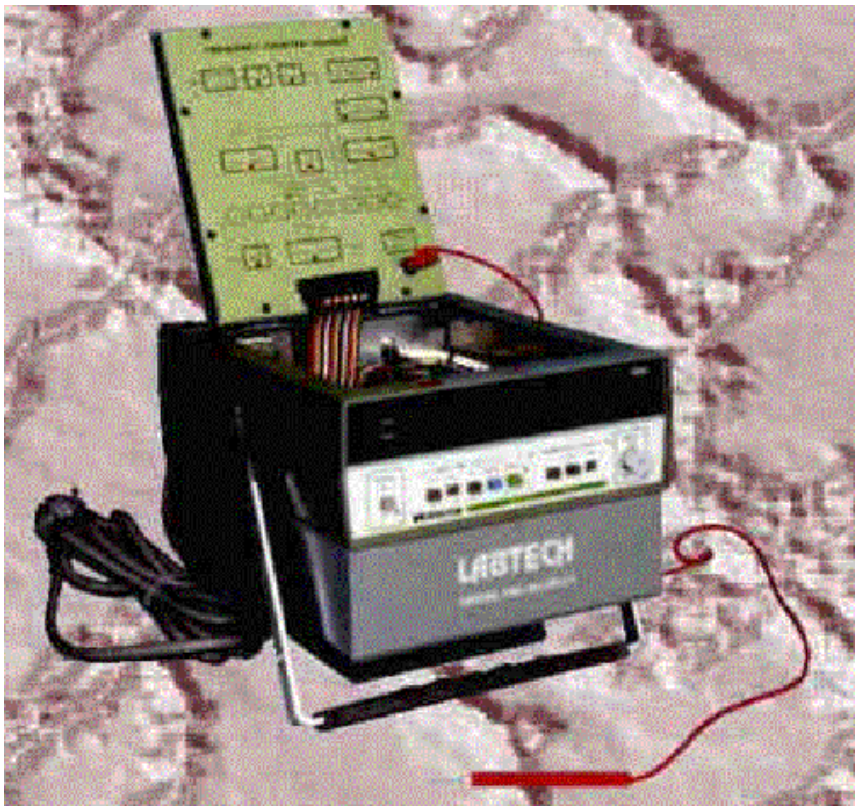
- transmitter frequency	:	167.2 MHz
- transmitter power	:	approx. 5 Watts
- termination	:	approx. 50 Ohm unbalanced
- antenna construction	:	nickel plated brass rods in various shapes, voltage and current defector display by linear led radiation detector half wave dipole with amplifier.
- power source	:	220 V, 50 Hz
- instruction book	:	student experiment manual

Topics Covered :

a. basic theory of radiation, radiating and non radiating systems.
b. feeders
c. radiation resistance, drive point impedance and ground resistance
d. physical and electrical length
e. directional antennas and radiation pattern
f. parasistic arrays and antenna gain
g. antenna with folded elements (open dipole, folded dipole)
h. slot radiator
i. loop antenna
j. adcock antenna
k. three dimensional polar diagram



(ELI1)
frequency counter trainer



Item : frequency counter trainer
Model : ELI-FCT-1

The electrotrain laboratory instrumentation series of trainers are designed to instruct in the proper use, operation, function, theory, and construction of each specific instrument.

The courseware covers topics including the theory of how frequency counters work, the specific operation of the circuitry inside the training unit, the purpose and use of frequency counters, the procedures for making proper measurements, use of the instrument and troubleshooting frequency counters. There are two main instructional aims to this trainer. The first aim is to instruct the student in the proper use of frequency counters which is a basic skill required by all electronics technicians. The second aim is to provide the knowledge for troubleshooting and repair skills as required for an instrumentation technician.

The frequency counter trainer is based upon a standard commercial frequency counter which has been modified to provide easy access to the internal circuitry. We have also added onto the unit Labtech's special electronic fault system that provides 10 selectable electronic faults. An illuminated circuit block diagram represents the

location of the faults. The location of the faults may be displayed or switched off for testing purposes.

In addition to being used as a trainer, this unit is also fully functional as a laboratory test instrument. Trainer comes complete with operation manual and student exercises.

This frequency counter provides accurate, reliable frequency and period measurements for a wide variety of laboratory, communications and bench applications. LSI and MSI technology results in cost-effective instrumentation for today's stringent requirements.

Large fluorescent displays make these instruments particularly well suited to production testing and other applications where a large, bright read-out is essential. The unit is housed in well-shielded metal case, which virtually eliminates errors caused by nearby r.f. fields.

In addition to frequency read-out, period measurements can also be made. Normally, a sampling rate of ten seconds can be expected for direct frequency read-out when the test signal frequency is very low and resolution to 0.01 Hz or greater is required. The period function can be used to reduce sampling time and to increase the accuracy of the measurement while increasing the resolution significantly. In the period mode, the time duration of one period is measured, averaged over the gate time. A reading of 16.09 milliseconds for instance, can be converted to 62.15 Hz using the relationship f = 1/t. The period mode is particularly useful when performing high-resolution frequency adjustments because the counter read-out permits constant observation of any change in frequency.

Universal Counter

- **frequency from 5hz to 100mhz**
- **frequency, period (period average), totalize, frequency ratio and time interval functions**
- **10m VRMS high sensitivity**
- **5 ppm high stability time base**
- **display check function**

Specifications

frequency measurements (CHA)	
ranges	5Hz to 100MHz.
gate time	0.01s, 0.1s, 1s, 10s, in 4 ranges.
resolution	100Hz, 10Hz, 1Hz, 0.1Hz.
accuracy	(time base accuracy + 1 count).
read-out	displayed KHz with decimal point.
period measurements (CHA)	
range	5hz to 25 MHz (0.04 us ~ 0.2s).
resolution	clock frequency 10MHz. 0.1us to 0.1ns 4 ranges.
accuracy	time base accuracy +/-1 count
read-out	trigger error of signal. displayed us with decimal point.
Totalize measurements (CHA)	
range	5Hz to 10MHz
counting	99999999 8 digits 0.3" led display.
capacity	
display	digits only, no decimal or annouciator.

ratio measurements	
display	f1/f2 (applied at CHA and b inputs).
range	f1: 5Hz to 100MHz f2: 5Hz to 25MHz.
accuracy	+/-1 count of signal on CHA + trigger error of signal on CHB.
time interval measurements	
range	0.4us to 0.2s.
input	channels a and b common.
resolution	0.1us to 0.1ns in 4 ranges.
accuracy	+/-1 count ñ time base accuracy + trigger error.
read-out	automatically displayed us with decimal point.
sensitivity	
input a	5Hz~60MHz < 10m VRMS, 60MHz~100MHz < 20m VRMS.
input b	5Hz ~ 25MHz < 10m VRMS.
input impedance	1mw//30pf.
operating temp.	0øc ~ 50øc.
storage temp.	-10øc ~ +70øc.
power source	ac 110, 220, 240v +/-10% 50/60hz.
accessories	test lead gtl-101 x 2 instruction manual x 1
dimensions	230(w) x 95(h) x 280(d) mm.
weight	1.8kg.

(ELI2)
oscilloscope trainer

Item : oscilloscope trainer
Model : ELI-OSC-1

The electrotrain laboratory instrumentation series of trainers are designed to instruct in the proper use, operation, function, theory, and construction of each specific instrument.

The courseware covers topics including the theory of how oscilloscopes work, the specific operation of the circuitry inside the training unit, the purpose and use of oscilloscopes, the procedures for making proper measurements, use of the instrument and troubleshooting oscilloscopes. There are two main instructional aims to this trainer. The first aim is to instruct the student in the proper use of oscilloscopes, which is a basic skill required by all electronics technicians. The second aim is to provide the knowledge for troubleshooting and repair skills as required for an instrumentation technician.

The oscilloscope trainer is based upon a standard commercial 20 MHz, dual trace oscilloscope that has been modified to provide easy access to the internal circuitry. We have also added onto the unit Labtech's special electronic fault system that provides 10 selectable electronic faults. An illuminated circuit block diagram

represents the location of the faults. The location of the faults may be displayed or switched off for testing purposes.

In addition to being used as a trainer, this unit is also fully functional as a laboratory test instrument. Trainer comes complete with operation manual and student exercises.

Specification:

vertical system:	
sensitivity	5mv/div 5v/div 3%, 1mv/div 1v/div 5% when using x 5 mag.
bandwidth	DC (AC 10 Hz) 20 MHz (-3db, 8div). DC (AC 10 Hz) 15 MHz (-3db, 8div) when using x 5 mag.
rise time	17.5ns, (23ns when using x 5 mag).
input impedance	approx. 1m
input coupling mode	AC, DC, and GND.
polarity	CH2 only.
display mode	CH1, CH2, DUAL, ADD. (dual automatic switching ALT and CHOP).
chop frequency	approx. 250 KHz.
ch1 output signal	50mv/div into 50
horizontal system:	
sweep time	range a 0.2s 0.5s/div 3% 100ns 50ms/div 5% (x 10 mag). 20ns 50ns 8% (x 10 mag)
sweep mode	AUTO, NORM, SINGLE
trigger:	
trigger source	CH1, CH2, ALT, LINE, AND EXT.
trigger coupling	AC, DC, HF REJ, and TV.
trigger slope	"+" or "-"
x-Y operation:	
sensitivity	5mv 5v/div 4%
bandwidth	DC 1 MHz.
phase difference	DC 50KHz less than 3 degrees at 50 KHz.
z axis:	
input impedance	aprrox. 5k
sensitivity	above 3 Vp-p
frequency response	DC 5MHz
calibrator:	1 KHz square wave, 2 Vp-p 2%
cRT:	6-inch rectangular with internal graticule approx. 2.2 kv accelerating potential 8 x 6 div display area (1 div = 10mm).
power source:	AC 100, 120, 220, 240v 10%, 50/60hz. approx. 35va.
accessories:	probes (10:1/1:1) x 2. instruction manual x 1.
dimensions:	310(w) x 155(h) x 455(d) mm.
weight:	approx. 7.1 kg

(EFT1A)
Basic Electricity Trainer, Plug-in module type

Item : Basic Electricity Trainer

Model : EFT-ELC-1 Plug-in Component Circuit Matrix Trainer

Labtech's basic electricity trainer is a modular course covering the fundamentals, concepts, theory and applications of electricity. It is designed as a starter course to provide new students with a good solid grounding in this area, which is so important for future studies. The basic electricity training program is ideal as one of the first courses for students studying electrical disciplines. It is also suitable for electronics students who want a more complete grounding in the basics, and can be taken as a prelude to the labtech basic electronics course.

The courseware is based upon the text lab manual "basic electricity" by Paul Zbar. This manual has gained acceptance around the world as one of the finest texts available today for introductory students. It has been developed in cooperation with the electronics industries association (EIA), of the United States and is recommended by them for industrial technician training. The EIA has stated "the aim of this basic instructional series is to supply schools with a well-integrated, standardized training program, fashioned to produce a technician tailored to industry's needs.

The trainer consists of a base station into which are plugged in a number of modular boards that match the experiments. Fifty-seven experiments are provided which cover basic electrical theory, electric circuits and passive devices in both direct and alternating current. The base station provides the power supplies, basic instrumentation and accessories that are required to support the training module boards.

General Specifications:

a. Base station :

Student Base Stations: This unit serves as the platform for carrying out the student experiments. Experiment modules are inserted into the base station and inter-connected to the services provided by the base station through 2mm sockets and test leads. The base station provides for all the primary needs of the experiment modules, and includes a variety of components such as the following:

1. fixed regulated dc power supplies: +5v, +15v, -15v
2. fixed AC power +6V, -6V, +7.5V, -7.5V
   +9V, -9V, +12V, -12V
3. variable regulated DC power supply 0 - 25v
4. potentiometers: 4 units
5. speaker: 2.25 inch, 8 Ohm/0.25W
6. one set of 2mm stackable test leads to perform all required inter-connections.
7. component circuit matrix board (to receive and connect component modules)

b. Set of PCB board experiment modules:

A comprehensive set of plug-in components are provided to carry out the experiments. Each module contains an electrical/electronic component which is visible to the student. The component circuit diagram is silk-screened onto the plexiglass surface. The student may use the diagram on each component as a guide to build the circuits thereby he is able to visualize the circuit diagram and also associate the component with it. Each circuit exercise as it is completed will resemble the circuit diagram in the courseware. This system is ideal for integrating theoretical and practical exercises. Components include many types of batteries, switches, resistors, capacitors, magnets, solenoid, potentiometers, transformer, relay, thermistor, varistor, lamps, led photo sensor.

c. Topics Experiments :

- introduction to experiments (schematic diagrams, symbols, power sources, instruments).
- resistor color code
- measurement of dc voltage, current, resistance
- conductors and insulators
- signal generator operation
- peak, RMS, and average values of AC
- characteristics of inductance and reactance
- frequency and phase measurements

- Ohm's law
- series and parallel circuits
- voltage-divider circuits
- Kirchhoff's law
- troubleshooting electric circuits
- power transfer (DC load)
- solving linear circuits
- balanced-bridge circuit
- superposition theorem
- Norton's theorem
- Millman's theorem
- magnetic fields and coils
- DC relay and magnetism
- oscilloscope operation
- inductances
- RC time constants
- reactance of a capacitor
- capacitive voltage divider
- impedance
- power in AC circuits
- frequency response
- effects of changes in frequency on impedance and current
- resonant frequency and frequency response
- parallel resonant circuits
- low-pass and high pass filters
- thermistors
- varistors

d. Textbook and Experiment Manual

Includes step-by-step chapters with practical experiments. Each chapter also includes student test.

e. Additional (optional) Instruments equired for carrying out all experiments.

ETI-AMM	Analog Multimeter	ETI-OSI	Dual trace 20 MHz Oscilloscope
ETI-DMM	Digital Multimeter	ETI-VAT	Variable Auto Transformer
ETI-FGR	Function Generator		

(EFT1B)
Basic Electricity Trainer, PCB Module Type

Item : Basic Electricity Trainer

Model : EFT-ELC-2 PCB Modular Trainer (5 PCB modules)

Labtech's basic electricity trainer is a modular course covering the fundamentals, concepts, theory and applications of electricity. It is designed as a starter course to provide new students with a good solid grounding in this area, which is so important for future studies. The basic electricity-training program is ideal as one of the first courses for students studying electrical disciplines. It is also suitable for electronics students who want a more complete grounding in the basics, and can be taken as a prelude to the labtech basic electronics course.

The courseware is based upon the text lab manual "basic electricity" by Paul Zbar. This manual has gained acceptance around the world as one of the finest texts available today for introductory students. It has been developed in cooperation with the electronics industries association (EIA), of the United States and is recommended by them for industrial technician training. The EIA has stated, "The aim of this basic instructional series is to supply schools with a well-integrated, standardized training program, fashioned to produce a technician tailored to industry's needs.

The trainer consists of a base station into which are inserted 5 of modular boards that match the experiments. Fifty-seven experiments are provided which cover basic electrical theory, electric circuits and passive devices in both direct and alternating current. The base station provides the power supplies, basic instrumentation and accessories that are required to support the training module boards.

General Specifications:

Trainer consists of a base station which contains the component circuit matrix board onto which the components can be mounted. Base station also contains various required power supplies and potentiometers. A set of electrical/electronic components plug in modules are provided which are used to assemble the circuits required to demonstrate the experiments.

a. Base Station :

Student Base Station: This unit serves as the platform for carrying out the student experiments. Experiment component modules are inserted into the matrix and inter-connected to the services provided by the base station through sockets and test leads. The base station provides for all the primary needs of the experiment modules and includes a variety of features as per the following list:

1. fixed regulated dc power supplies: +5v, +15v, -15v
2. fixed ac power +6v, -6v, +7.5v, -7.5v
   +9v, -9v, +12v, -12v
3. variable regulated dc power supply 0 - 25v
4. potentiometers: 4 units
5. speakers: 2.25 inch, 8 Ohm/0.25W
6. one set of 2mm stackable test leads to perform all required inter-connections.
7. component circuit matrix board (to receive and connect component modules)

b. Set of plug-in component modules:

A comprehensive set of PCB modular are provided to carry out the experiments. Each module contains an electrical/electronic component which is visible to the student. The component circuit diagram is silk-screened onto the plexiglass surface. The student may use the diagram on each component as a guide to build the circuits thereby he is able to visualize the circuit diagram and also associate the component with it. Each circuit exercise as it is completed will resemble the circuit diagram in the courseware. This system is ideal for integrating theoretical and practical exercises. Components include many types of batteries, switches, resistors, capacitors, magnets, solenoid, potentiometers, transformer, relay, thermistor, varistor, lamps, led photo sensor.

c. Topics of experiments :

- introduction to experiments (schematic diagrams, symbols, power sources, instruments).
- resistor color code
- measurement of dc voltage, current, resistance
- conductors and insulators
- Ohm's law
- series and parallel circuits
- voltage-divider circuits
- Kirchhoff's law
- troubleshooting electric circuits
- power transfer (DC load)
- signal generator operation
- peak, RMS, and average values of ac
- characteristics of inductance and reactance
- frequency and phase measurements
- inductances
- RC time constants
- reactance of a capacitor
- capacitive voltage divider
- impedance
- power in AC circuits

- solving linear circuits
- balanced-bridge circuit
- superposition theorem
- Norton's theorem
- Millman's theorem
- magnetic fields and coils
- DC relay and magnetism
- oscilloscope operation
- frequency response
- effects of changes in frequency on impedance and current
- resonant frequency and frequency response
- parallel resonant circuits
- low-pass and high pass filters
- thermistors
- varistors

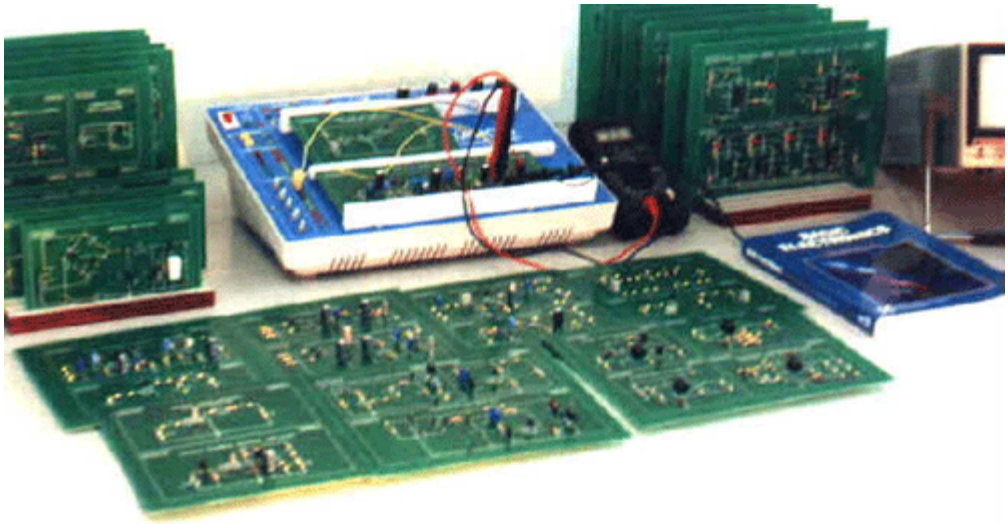
d. Textbook and experiment manual.

Includes step-by-step chapters with practical experiments. Each chapter also includes student test.

e. Required additional (optional) instruments for completing all experiments :

ETI-AMM	Analog Multimeter	ETI-OSI	Dual Trace 20Mhz Oscilloscope
ETI-DMM	Digital Multimeter	ETI-VAT	Variable Auto Transformer
ETI-FGR	Function Generator		

(EFT2A)
basic electronics trainer, circuit based training series



ITEM : CIRCUIT BASED TRAINING SERIES

Labtech is now making available its extensive range of circuit based training boards by topic groups to address specific training needs. This makes it easier for teachers and instructors to target upgrading specific skills for their training programs. These boards are designed for circuit based training and provide many examples of operational circuits relevant to each series topic. The boards are clearly laid out and

require the students to connect key parts of the circuit as part of the exercises. This hands on activity helps to relate the theory to the practical applications.

In many cases the circuits are designed to allow circuit modifications. The benefit of this is that the student is not exposed to only static circuits but he can modify them by changing key components featuring different values. In this way he can see the performance of the circuit and how it will react when components of different values are substituted.

The PCB modules can be ordered as sets below. Each set consists of a series of PCB modules and the related courseware containing the theory and student experiments. The modules can be used in the basic electronics base station (model number eft-lbs-2)

Each module consists of high quality epoxy coated fiberglass printed circuit board with the electronic components mounted onto the surface. Each board is printed with a neatly laid out silk-screened schematic circuit diagram showing the circuit construction and operation. The experiment boards are designed to be very educational and to reinforce the link between the theoretical and practical aspects. All the components and connections (PCB tracks) in each circuit are clearly visible and can be associated with schematic diagram, nothing is hidden from view.

module names	**module**	**module names**	**module**
series 1	**model no.: EFT-ETX-S1**	**series 2**	**model no.: EFT-ETX-S2**
semiconductor diode and it's circuits.		**rectifiers and power supply circuits**	
ETX-52001-1	junction diode	ETX-52003-4	full wave & half wave voltage rectifier
ETX-52001-2	zener characteristic	ETX-52004-1	transformer power supply and filters
ETX-52002-1	zener regulator	ETX-52004-2	power supply troubleshooting
ETX-52002-2	LED data	ETX-52005-1	bridge rectifier
ETX-52002-3	7' segment display	ETX-52005-2	short circuit protection
ETX-52002-4	7' segment display circuit	ETX-52018-3	voltage regulator
ETX-52002-5	optocoupler circuit	ETX-52018-4	IC regulator
ETX-52003-1	diode limiter & clamper		
ETX-52003-2	connecting oscilloscope	**series 4**	**model no.: EFT-ETX-S4**
ETX-52003-3	double diode limiter	**amplifier characteristic and circuits**	
		ETX-52008	load line analysis of a transistor amplifier
series 3	**model no.: EFT-ETX-S3**	ETX-52009	cascaded transistor amplifier

transistor fundamentals and circuits

ETX-52006-1	transistor familiarization	ETX-52010	push-pull power amplifier
ETX-52006-2	current gain of transistor	ETX-52011	audio amplifier using one power supply
ETX-52007-1	common emitter amplifier	ETX-52012-1	audio amplifier frequency response
ETX-52007-2	emitter follower	ETX-52014-1	transistors differential amplifier
		ETX-52014-2	linear IC audio power amplifier

series 5 model no.: EFT-ETX-S5

Fet characteristic and circuits

ETX-52012-2	JFET familiarization
ETX-52013-1	MOSFET gate control characteristics
ETX-52013-2	MOSFET common source amplifier

series 6 model no.: EFT-ETX-S6

operational amplifier circuits

ETX-52015-1	input bias current, inverting and non-inverting amplifier
ETX-52015-2	summing amplifier
ETX-52015-3	bias current testing with c filter
ETX-52015-4	input voltage offset and measuring voltage offset with oscilloscope
ETX-52016-1	slew rate measurement
ETX-52016-2	closed-loop gain
ETX-52016-3	electronic voltmeter
ETX-52016-4	electronic amperemeter and current gain measurement
ETX-52017-1	comparator
ETX-52017-2	half wave rectifier
ETX-52017-3	limiter
ETX-52017-4	active filter (lPF) first order
ETX-52018-1	active filter (LPF)
ETX-52018-2	active filter (HPF) second order
ETX-52018-3	differentiator circuit
ETX-52018-4	integrator circuit
ETX-52020	op-amp troubleshooting

series 7 model no.: EFT-ETX-S7

oscillator circuits

ETX-52019-1	Hartley oscillator
ETX-52019-2	Op-amp oscillator

series 9 model no.: EFT-ETX-S9

digital circuits

ETX-52022-3	and gate or gate and or gate
ETX-52023-1	full adder

(Wien bridge)			
ETX-52019-3	phase shift oscillator	ETX-52023-2	rS latch
ETX-52019-4 (twin-t oscillator)	Op-amp oscillator	ETX-52023-3	clocked d flip-flop
ETX-52019-5	Armstrong oscillator	ETX-52024-1 flip-flop	edge trigger d flip-
ETX-52019-6	Colpitts oscillator	ETX-52024-2 flip-flop	edge triggered jK
ETX-52019-7	crystal oscillator	ETX-52024-3 and ring counter	binary up counter
ETX-52021-1 oscillator	triangular wave	ETX-52027 conversion	a/D and d/A

series 8 model no.: eFT-ETX-s8

waveform generating circuits

ETX-52021-2	sawtooth and variable ramp generator
ETX-52021-3	Schmitt circuit
ETX-52022-1	astable multivibrator and monostable multivibrator
ETX-52022-2	Schmitt trigger driving a multivibrator and charging current
ETX-52022-4	bistable multivibrator

series 10 model no.: eFT-ETX-s10

basic communication circuits

ETX-52025-1	mixer, envelope detector and amplitude modulator
ETX-52025-2	PLL (phase-locked loop)

series 11 model no.: eFT-ETX-s11

power control components and circuits

ETX-52025-3	SCR characteristics
ETX-52025-4 AC anoda source	DC gate control and
ETX-52026-1 AC anoda source	AC gate control and
ETX-52026-2	relaxation oscillator
ETX-52026-3 UJT	triggering SCR with
ETX-52028-1 familiarization	Diac circuit
ETX-52028-2 familiarization	Triac circuit

series 12 model no.: eFT-ETX-s12

electronic application circuits

ETX-52029-1	basic electronic application module 1 (Op-amp applications)
ETX-52029-2	basic electronic application module 2 (DC regulation circuits)

ETX-52029-3	basic electronic application module 3 (control circuits)
ETX-52029-4	basic electronic application module 4 (signal generator)
ETX-52030-5	basic electronic application module 5 (switching power supply)

EFT-LBS-2 basic electronics base station

This unit serves as the platform for carrying out the student experiments. experiment modules are inserted into the base station and inter-connected to the services provided by the base station through 2 mm sockets and test leads. The base station provides for all the primary needs of the experiment modules, and includes a variety of components such as the following:

1. fixed regulated dc power supplies : +5v, +15v, -15v
2. variable regulated dc power supply 0 - 25v
3. potentiometers : 4 units
4. pulse switches : 2 units
5. 8 bits LED display.
6. toggle switches : 5 spdt
7. speaker : 2.25 inch, 8 Ohm/0.25W
8. one set of 2 mm stackable test leads to perform all required inter-connections.

Ordering Information:

Complete set EFT-ETX-1:

The EFT-ETX-1 model number is for the complete set of modules including the base station and test leads.

Individual Series:

To order by module grouping use the series number for each series required (example: EFT-ETX-S10)

Test leads are included with check module. The basic electronics base station EFT-LBS-2 is also required for operation of the training modules.

(EFT2B)
basic electronics trainer, component based PCB module

ITEM : BASIC ELECTRONICS TRAINER

MODEL : EFT - ETX-2 COMPONENT AND CIRCUIT BASED (7 PCB MODULES)

Labtech's basic electronics trainer is a modular course covering the fundamentals, concepts, theory and applications of electronics. It is designed as a starter course to provide new students with a good solid grounding in this area, before going on to specialized studies. The basic electronics-training program is ideal for basic and intermediate studies in this field. Please note that for additional fundamental topics, including electrical applications, the student may desire to take the basic electrical trainer course prior to the electronics trainer.

The courseware is based upon the text lab manual "basic electronics" by Paul Zbar. This manual has gained acceptance around the world as one of the finest texts available today for introductory students. It has been developed in cooperation with the electronics industries association (EIA), of the United States and is recommended by them for industrial technician training. The EIA has stated, "The aim of this basic instructional series is to supply schools with a well-integrated, standardized training program, fashioned to produce a technician tailored to industry's needs".

The trainer consists of a base station into which are plugged in 7 modular boards that match the experiments. Fifty-two experiments are provided which cover basic electronic theory, electronic solid-state circuits, semi-conductors, amp circuits and basic digital applications. The base station provides the power supplies, basic instrumentation and accessories that are required to support the training module boards.

GENERAL SPECIFICATIONS:

a. Base Station:

Student base station: this unit serves as the platform for carrying out the student experiments. Experiment modules are inserted into the base station and inter-connected to the services provided by the base station through 2 mm sockets and test leads. The base station provides for all the primary needs of the experiment modules, and includes a variety of components such as the following:

- 1. fixed regulated dc power supplies: +5v, +15v, -15v
- 2. variable regulated dc power supply 0 - 25v
- 3. potentiometers: 4 units
- 4. pulse switches: 2 units
- 5. 8 bits led display.
- 6. toggle switches: 5 spdt
- 7. speaker: 2.25 inch, 8 ohm/0.25w
- 8. one set of 2 mm stackable test leads to perform all required interconnections.

b. Set of PCB board experiment modules:

The trainer comes with a complete set of 7 experimental board modules that closely follows the courseware. Each module consists of a high quality epoxy coated fiberglass printed circuit board with the electronic components mounted onto the surface. Each board is printed with a clearly laid out silk screened schematic circuit diagram showing circuit construction and operation. The experiment boards are designed to be very educational and to reinforce the link between the theoretical and practical aspects. The PCB modules have all the components requested for the experiments mounted on to them. Connection is made by 2mm stackable test leads, which are provided.

The training program is designed also in many cases to allow circuit modification by substituting components. The benefit of this is that the student is not exposed to only static circuits only but he can modify them by changing certain values. In this way students can explore how the performance and characteristics of the circuit design can change by altering different values.

c. Topics of Experiments :

- junction diode characteristics
- zener diode characteristics
- optoelectronic devices
- diode limiter and clamper
- half wave and full wave rectification
- transformer power supply and filter
- power supply troubleshooting
- bridge rectifier
- transistor familiarization
- current gain common emitter
- collector
- diode and transistor testing
- common emitter amplifier biasing and gain
- differential amplifier
- the linear amplifier
- operational amplifier
- negative feedback
- op amp circuits
- active filters
- voltage regulation
- three terminal iC regulators
- hartley oscillator
- phase shift oscillator
- op amp oscillator
- schmitt trigger

- common emitter amplifier impedance. power and phase relationships
- troubleshooting aC amplifier
- emitter follower
- load line analysis
- cascaded transistor amplifier
- push pull power amplifier
- frequency response of an audio amplifier
- jFET
- mOSFET
- the 555 timer
- digital integrated circuits
- the inverter, nor gate, nand gate
- binary addition full adder
- flip flops
- counters
- mixers, modulators, and demodulators
- phase-locked loop
- silicon controlled rectifier
- unijunction transistor
- characteristics of a cathode ray tube (cRT)

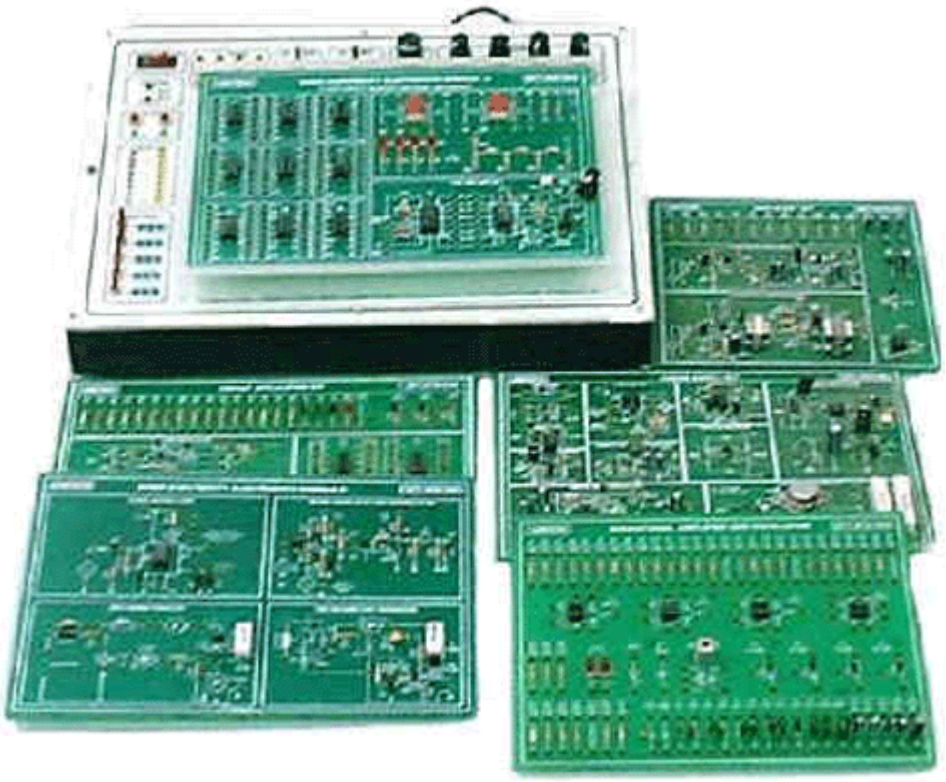
d. Textbook and experiment manual.

Includes step-by-step chapters with practical experiments. Each chapter also includes student test

e. Additional (optional) instruments required for carrying out all experiments.

ETI-AMM	Analog Multimeter	ETI-OSI	dual trace 20mhz oscilloscope
ETI-DMM	Digital Multimeter	ETI-FRC	frequency counter
ETI-FGR	Function Generator	ETI-CTR	curve tracer

(EFT3)
electronics fundamentals



ITEM : ELECTRICITY AND ELECTRONICS FUNDAMENTALS TRAINER
MODEL : EFT-BEE

Labtech's electricity and electronics fundamentals trainer is a modular course covering the concepts, theory and applications of basic electricity and electronics that are required for technicians. This comprehensive course is presented in a systematic way starting the student out at the beginning covering basic theory and measurements with meters. It then progress to fundamental theorems and laws with basic circuits and principles of magnetism and AC/DC power. Next various types of devices are covered suction resistors, capacitors, diodes, semiconductors etc. From here the student proceeds on with various types of circuits such as power supplies, emitter, amps, op amps and then finished with basic concepts of digital logic circuits with some applications for AD and DA conversion, counters and decoders.

The courseware is based upon the text lab manual "Electricity and Electronics Fundamentals" by Paul Zbar and Joseph Sloop. It has been developed in cooperation with the electronics industries association (EIA), of the United States and is recommended by them for industrial technician training. It is an industry recommended school tested laboratory program perfectly suited as an introductory course for electronic service technicians and is also well suited for use in technical high schools and two-year colleges or polytechnics.

Many of the primary service requirements for all experiments such as power supply, switches, and potentiometers are provided on the base station. The experiments are contained on a series of PCB type modules which are inserted into the base station during use. 2mm connection points are utilized on the PCB modules thus allowing the student to use the test leads to wire up the experiments and modify the circuits. It is a time and cost saving device for both students and researchers interested in doing experiments and testing circuits. A comprehensive textbook and experiment manual are provided to be used together as a guide for the students in doing the experiments.

General Specifications:

a. Base Station:

Student base station: this unit serves as the platform for carrying out the student experiments. Experiment modules are inserted into the base station and interconnected to the services provided by the base station through 2 mm sockets and test leads. The base station provides for all the primary needs of the experiment modules, and includes a variety of components such as the following:

1. 1. fixed regulated dc power supplies : +5v, +15v, -15v
2. 2. variable regulated dc power supply 0 - 25v
3. 3. potentiometers: 4 units
4. 4. pulse switches: 2 units
5. 5. 8 bits led display.
6. 6. toggle switches: 5 spdt
7. 7. speaker: 2.25 inch, 8 ohm/0.25w
8. 8. one set of 2 mm stackable test leads to perform all required inter-connections.

b. Set of PCB board experiment modules:

The trainer comes with a complete set of experimental board modules that closely follows the courseware. Each module consists of a high quality epoxy coated fibber glass printed circuit board with the electronic components mounted onto the surface. Each board is printed with a clearly laid out silk-screened schematic circuit or component diagram. The experiment boards are designed to be very educational and to reinforce the link between the theoretical and practical aspects. All the components and connections (PCB tracks) in each circuit are clearly visible and can be associated with the schematic diagram, nothing is hidden from view.

c. Topics of Experiments :

- electrical and electronic symbols &
- nonlinear devices

schematic diagrams
- electricity/electronic safety
- using the multimeter
- series and parallel resistance circuits
- voltage and voltage measurement
- measurement and control of dC
- ohm's law and the series circuit
- the parallel circuit
- series-parallel circuits
- kirchoff's laws
- thevenin's theorem
- power
- electricity and magnetism
- alternating current measurement
- capacitors
- capacitive reactance and phase measurement
- inductance
- series rL and rC circuit characteristics
- the series resonant circuit
- parallel resonance
- power in aC circuits
- filter circuits
- semiconductor diodes
- diode circuits
- power supply circuits
- junction transistors
- common emitter amplifier characteristics
- the emitter follower amplifier
- advanced transistor amplifier circuits
- audio amplifier characteristics
- differential amplifier
- field-effect transistors and amplifiers
- linear integrated circuits
- op amp circuits
- oscillators
- multivibrators
- 555 timer
- large-scale iC signal generation
- signal control circuits
- solid-state switches
- digital iC gate circuits
- analog-to-digital conversion
- digital-to-analog conversion
- digital iC decoders

d. Textbook and experiment manual.

Includes step-by-step chapters with practical experiments. Each chapter also includes student test.

e. Additional (optional) instruments required for carrying out all experiments.

ETI-AMM	analog multimeter
ETI-DMM	digital multimeter
ETI-FGR	function generator
ETI-OSI	dual trace 20mhz oscilloscope
ETI-FRC	frequency counter
ETI-CTR	curve tracer

(EFT4A)
Digital Trainer

ITEM : DIGITAL TRAINER
MODEL : EFT-DTL Digital Logic Training System
EFT-DTA Advanced Digital Logic Training System

Labtech's Digital Trainer is a modular course covering concepts, theory and applications for digital electronics training. It is designed start the student with the basics of digital technology and goes onto advanced digital topics. The level of training is further extended with the applications boards which allow the student to apply his knowledge to real circuit applications.

The trainer is available in a variety of configurations as it is in a modular format. This allows our system to meet the requirements of most teachers and schools. Each of the modules has it's own courseware which is integrated into the complete system. A description of the modules is contained on the reverse side of this brochure.

The modules are designed to work with the base station which provides common facilities that are required for the experiments. The base station features a multiple output power supply, clock generator, logic indicator, data switches, toggle switches, push buttons, pulsars and seven segment displays.

Please note that this trainer contains over 40 different types of ICs for the student to explore. This makes this trainer one of the most comprehensive and complete digital training systems on the market today.

Technical Specifications:

a. Base Station EFT-DTB:

student base station: this unit serves as the platform for carrying out the student experiments. Experiment modules are inserted into the base station and inter-connected to the services provided by the base station through 2 mm sockets and test leads. The base station provides for all the primary needs of the experiment modules, and includes a variety of components such as the following:

1.	power supply	:	fixed +5 Vdc, +15 Vdc, -15Vdc, variable 1.5 ~ 15 Vdc
2.	logic indicator	:	16 logic indicators
3.	data switch	:	16 data switches (for TTL and CMOS)
4.	toggle switch	:	4 toggle switches (spdt)
5.	push button	:	3 push buttons (2no, 1nc)
6.	pulser	:	2 pulsers, (a,a and b, b)
7.	seven segment	:	4 seven segment digital displays.
8.	clock generator	:	1 Hz - 100 KHz
9.	One set of stackable test leads to make all required inter-connections		

b1. Digital Logic Training Modules Set EFT-DTL (topics are listed below)

- fundamental of and, or, inverter, nand, and nor.
- basis of and, or, inverter, nand and nor with ics.
- xor logic with IC.
- practical nand and nor gate circuits.
- active high and active low inputs and outputs.
- product of sums circuits.
- sum of products circuits.
- pulse distortion and propagation delay.
- Schmitt trigger gates.
- parity circuit.
- fundamental of diode and BJT logic.
- open collector TTL outputs.
- three state output
- D type latches.
- introduction to JK flip-flop.
- serial in shift register.
- parallel in shift register.
- fundamental of RS latches.

b2. Advanced Digital Logic Training Modules Set EFT-DTA (topics are listed below)

- binary ripple counters.
- modulus counters.
- binary counter IC devices.
- principle of synchronous binary counters.
- programmable up/ down binary counters.
- bi-directional and universal shift register.
- decimal to binary decoders.
- binary to decimal decoders.
- half adders and full adders.
- digital magnitude comparator circuit.
- multiplexer.
- demultiplexer.
- random access memory (RAM)
- digital to analog conversion.
- analog to digital conversion.

b3. Digital Application Modules EFT-DTX

EFT-DTX-1	digital switching network principle.
EFT-DTX-2	frequency to voltage converter.
EFT-DTX-3	voltage to frequency converter.
EFT-DTX-4	USART module.
EFT-DTX-5	breadboard module.

EFT-DTX-6	binary.
EFT-DTX-7	digital to analog and analog to digital.
EFT-DTX-8	computer fundamentals.

c. Textbook and Experiment Manual.

Includes step-by-step chapters with practical experiments. Each chapter also includes student test.

d. Additional (optional) Instruments required for carrying out all experiments.

ETI-OSI	dual trace 20 Mhz oscilloscope
ETI-DMM	digital multimeter
ETI-FGR	function generator
EFT-DTO-1	1 set of Components that can be used to do the experiments on the breadboard module.

Note **: Special application circuits which are not included in above list can be ordered upon request.**

(EFT4B)
Advanced Digital Applications Modules

ITEM : DIGITAL TRAINER
MODEL : EFT-DTX Advanced Digital Application Modules

This digital application modules trainer is designed to provide further and more extensive studies about some important digital circuits. The students are recommended to finish all experiments in Labtech Logic and Advanced digital trainer (EFT-DTL, EFT-DTA) before proceeding to this application trainer. The trainer offers wide range of most common digital application circuits that are used in digital electronics

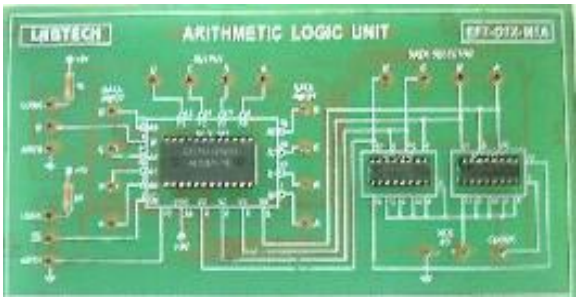
The trainer consists of a number of individual modules that can be used with the Digital electronics Lab Base Station (EFT-LBS-3). Each application circuit module is printed on a special design PCB that shows the circuit layout on top of the PCB (component side). In addition, the circuit path is able to be observed from the bottom side of the PCB (solder side). During the exercises, the student makes essential connections by using 2 mm stackable connection leads. In this way the student is able to construct and to complete the circuit in each of the practical exercises.

While doing the practical circuit exercises, the students are also expected to take many electronic instrument measurements in order to understand and to study the circuit electrical characteristics and behavior. The measurements are taken at the test point locations that are purposely provided for this reason.

The circuit module is placed on a digital base station that facilitates other requirements for the module such as: digital data switches, digital logic indicator, pulse switches, clock generator, seven segment displays etc. See page EFT10 and EFT04 for detail base station which is ordered separately.

A comprehensive experiment manual is provided to guide the students in studying the various application modules. This manual includes step-by-step instruction to prepare the modules for the experiment as well as some theory to strengthen the student's knowledge in areas that is important as a background which is needed before doing the experiment

1. ARITHMETIC LOGIC UNIT
MODEL : EFT-DTX-1



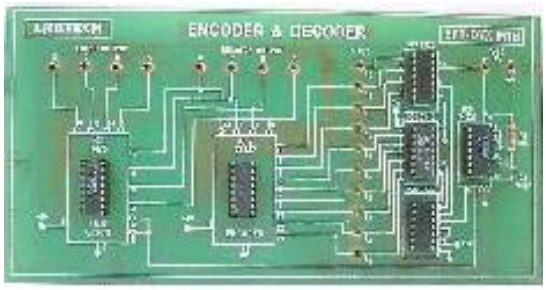
An Arithmetic Logic Unit is a device that does AND. OR, Add, Subtract functions and also performs a variety of other operations on binary word. This device is a very important part of the microprocessors and microcomputer systems.

- 74181 IC can be programmed with binary instruction on its selected inputs to perform arithmetic or logic operation on two 4 binary words.

- 7476 IC is used as data selector for logic operation in 74181

2. ENCODER AND DECODER APPLICATION
MODEL : EFT-DTX-2

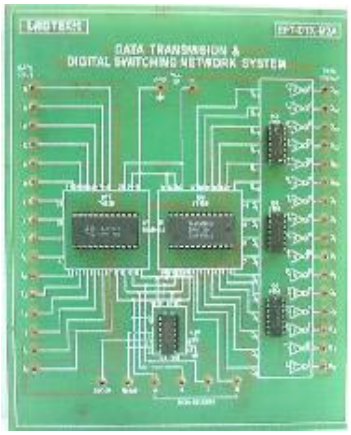
The Encoder translates the 10 inputs generated from the switches to be inverted to BCD forms. The" latch enable" circuitry generates a short pulse for each keystroke, which then transfers the to Encoder output.



The 4-bit latch holds BCD data at the Decoder inputs. The Decoder translates from BCD to seven-segment code. This code lights the proper segment on the seven-segment output display.

3. DATA TRANSMISSION AND DIGITAL SWITCHING NETWORK SYSTEM
MODEL : EFT-DTX-3

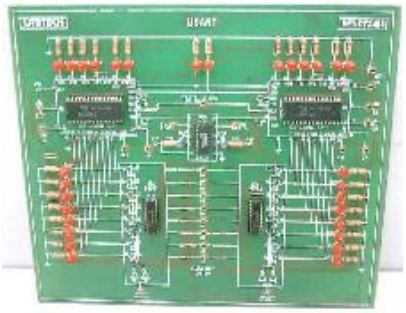
This device is used for sending and receiving serial data and are called multiplexers (MUX) and demultiplexers (DEMUX). Parallel data from one digital device is changed into serial data by the MUX. A single wire transmits the serial data. The serial is reassembled into parallel data at the output by the DEMUX. Notice the control lines that must also connect the MUX and DEMUX. These control lines keep the MUX and DEMUX synchronized. So that the 16 input lines are cut down to only a few transmission lines.



4. FREQUENCY TO VOLTAGE AND VOLTAGE TO FREQUENCY CONVERTER
MODEL : EFT-DTX-4

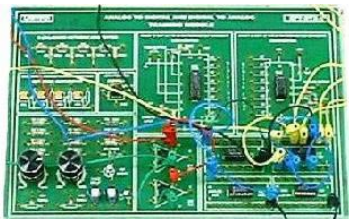
The LM 331 is a monolithic circuit designed for accuracy and versatile operation when applied as a voltage to frequency (V to F) converter or as a frequency to voltage (F to V) converter. The operation of these circuit blocks is best understood by going through the operating cycle of the basic V to F converter, which consists of the simplified block diagram of the LM 331 and various resistors and capacitors connected to it.

5. USART Modules
MODEL : EFT-DTX-5



To send and receive serial data, there must be a circuit that converts the parallel data to serial data and convert the serial data to parallel data. The shift register is the basic logic element used to do this job. The shit register can be loaded with parallel data. The register is then clocked (shift), and the data comes out one bit at a time (one bit for each clock cycle). To convert serial data to parallel data, we reverse the parallel to serial converter. The serial data is clocked into the shift register. Once all of the data word is in the register, the data is read from the shift register's parallel outputs. The device that does all of these functions is called a USART. The 8251 USART device is used in this application module.

6. ANALOG TO DIGITAL CONVERTER AND DIGITAL TO ANALOG CONVERTER
MODEL : EFT-DTX-6



The process of converting an analog voltage into an equivalent digital signal is known as " analog to digital (A/D) conversion". This operation is somewhat more complicated than the converse of D/A conversion. A number of different methods have been developed, the simplest of which is probably the simultaneous method.

The A/D circuit and D/A circuits help the students to understand various techniques in doing D to A and A to D conversion.

The Topics covered in this experiments are :

A) Weighed Resistances Ladder Network Converter
B) R-2R Ladder Network Converter
C) Fast 8-bit DAC
D) Fast 8-bit ADC

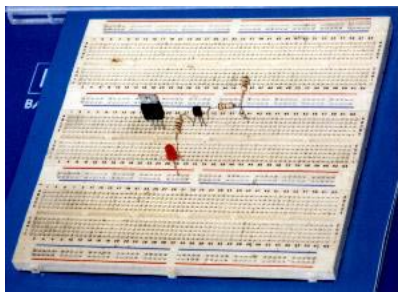
7. COMPUTER FUNDAMENTALS TRAINING MODULE
MODEL : EFT-DTX-7

This computer fundamentals training module provides excellent basic knowledge about microprocessor system. The module consist of medium side scale integrated circuits that are used in digital computer such as Arithmetic Logic Unit (ALU), Memory, Register, Data Selector decoder etc.

Topics of experiment covered :

1. Familiarization of microprocessor basic components
2. Registers
3. Decoders
4. Programmable Counters
5. Addition and Subtraction
6. Arithmetic Logic Unit (ALU)
7. Data Storage and Retrieval (Memory)
8. The Basic computer cycles
9. A Simple Complete Processor System

8. BREADBOARD MODULE
MODEL : EFT-DTX-8



This module is very useful for doing practical applications or some tests when building particular digital circuits or doing prototyping on some sections of the more complex digital circuit. The breadboard module is installed in such way so it can be inserted in to the railing system on the digital trainer base station.

(EFT5)
industrial electronics trainer

item : industrial electronics trainer (featuring power electronics)
Model : EFT-IPX

Labtech's industrial power electronics trainer is a modular course covering the fundamentals, concepts, theory and applications of industrial and power electronics that are in common use by industry for control of electrical systems, machines and processes. It is designed to cover the knowledge of power electronics technology such as fundamental understanding of power switching devices, control circuits, three phase systems and applications of power electronics devices. A number of experiments and related modules are provided for comprehensive training on each particular experiment topic. To gain a deeper understanding of the topics we suggest using the industrial power electronics trainer in conjunction with our basic electronics and basic electricity trainers as prerequisites.

The courseware is based upon the text lab manual "industrial electronics" by Paul Zbar and Richard Koelker. It has been developed in cooperation with the electronics industries association (EIA), of the United States and is recommended by them for industrial technician training. The EIA has stated, "The aim of this basic instructional series is to supply schools with a well-integrated, standardized training program, fashioned to produce a technician tailored to industry's needs.

All necessary equipments for all experiments such as power supply, switches, and meters are installed on the base station. The experiments are contained on a series of PCB type modules which are inserted into the base station during use. 2mm connection points are utilized on the PCB modules thus allowing the student to use the test leads to wire up the experiments and modify the circuits. It is a time and

cost saving device for both students and researchers interested in doing experiments and testing circuits. A comprehensive textbook and experiment manual are provided to be used together as a guide for the students in doing the experiments.

General Specifications:

a. Base Station:

Student base station: this unit serves as the platform for carrying out the student experiments. Experiment modules are inserted into the base station and inter-connected to the services provided by the base station through 2mm sockets and test leads. The base station provides for all the primary needs of the experiment modules, and includes a variety of components such as the following:

1. a. switches: 6 spst, 2 spdt , 2 pulse switches
2. b. potentiometers (variable resistors): 4 units
3. c. fixed regulated dc power supply: +5 Vdc, +15 Vdc, -15 Vdc.
4. d. variable regulated dc power supply: + 0 - 30 Vdc
5. e. AC power supply: 110vac single phase, 50 Hz
6. 220vac single phase, 50 Hz
7. 25vac - 0 - 25vac
8. f. one set of 2mm stackable test leads to perform all required interconnections.

b. Topics of Experiments:

- characteristics of a silicon rectifier
- the silicon controlled rectifier (SCR)
- rectification characteristics of an SCR
- phase-shift control of an SCR
- diac
- triac
- photoelectric devices
- relays
- optoelectronics : the phototransistor
- the lascr, the lED optoisolator
- solid-state relay (SSR)
- photoelectric control of an SCR
- timing circuits
- transistor time-delay relay
- UJT as a control device
- UJT controlled SCR time-delay circuits
- electronic voltage regulated power supply
- three phase half-wave rectifier
- three phase full-wave bridge rectifier
- astable multivibrator
- UJT controlled hybrid bistable multivibrator
- multivibrator and the Schmitt trigger
- digital integrated circuits : and or gates
- inverter, nor and nand gates
- binary addition, half and full adders
- flip-flop
- counters
- decoding counters and digital displays
- computers and microprocessors : introduction
- motors and motor controls
- SCR automatic control of the speed of a DC motor

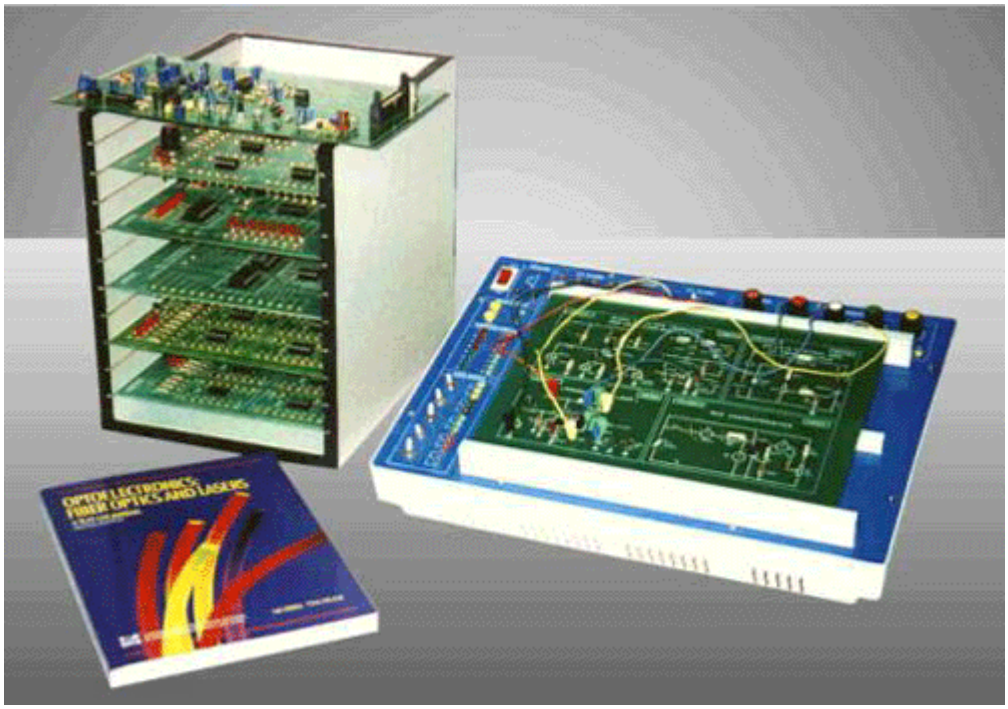
c. Textbook and experiment manual

Includes step-by-step chapters with practical experiments. Each chapter also includes student test.

d. Additional (optional) instruments required for carrying out all experiments.

ETI-OS3	20MHz power oscilloscope
ETI-DMM	digital multimeter
ETI-FGR	function generator
ETI-AMM	analog multimeter
ETI-PSI	variable low voltage dc power supply
ETI-PS2	variable regulated 400 Vdc power supply
ETI-IT	isolation transformer
ETI-AT1	variable auto transformer 60 hz
ETI-DCM-1	dc motor 1/6 hp.
ETI-ACM-1	ac motor 1/6 hp.
EFT-IPX-K	industrial power electronic kit

(EFT6)
optoelectronics



ITEM : OPTOELECTRONICS
Model : EFT-OPE-1

This high-technology laboratory course demonstrates the use of optoelectronic devices in a wide range of applications including office copy machines, biomedical instruments, telephone communications, aircraft equipment, consumer products and motor vehicles. The course covers the latest state-of-the-art devices used in applying optodevices to electric power, digital communications. Course participants

will learn from laboratory exercises and theoretical information how to use modern light emitter/sensor circuits and hardware in information flow circuits.

The opto electronics course includes discussions on the operation and application of light emitters, detectors, fiber optic cables and their hardware, along with applicable circuits in power, telecommunications, data transfer, bar code scanning and contacless switching. The course consists of modular PCB instruction units, a base station with power supply, jumper leads and the laboratory manual. Most experimental circuits are prewired, while others must be constructed.

experimental topics :

part 1 : introduction to optoelectronics

1. defining optoelectronics
2. applications and innovations
3. control and communications
4. the electromagnetic spectrum
5. communications by wireless
6. early uses of light systems
7. exciters, detectors and couplers
8. fiber optics and hardware

part 2 : the photo/pin diode, sensor, phototransistor, darlington phototransistor and optocoupler/isolator

9. characteristics and structure
10. diode/diode and diode/transistor couplers
11. measuring the current transfer ratio
12. pulse and aC linear couplers
13. the optical coupler

part 3 : lascr and triac couplers: circuit applications -- power

14. the isolated on-off controller
15. the flame-out monitor
16. the optical logic controller
17. the triac power controller
18. the automatic night lighting controller
19. the automatic night flasher
20. solid-state ac/dc power relays
21. power control with logic gates

part 4 : exciters, detectors and couplers

22. solid-state exciters -- LED
23. the visual spectrum
24. the incandescent lamp
25. red and infrared exciters
26. optical flux output
27. evaluating light emitters

part 5 : photoresistors and solar cells: circuit applications -- analog

28. digital transmitter/receiver circuits
29. a one-megabit nRZ transmitter
30. data communications receiver
31. bipolar transmission

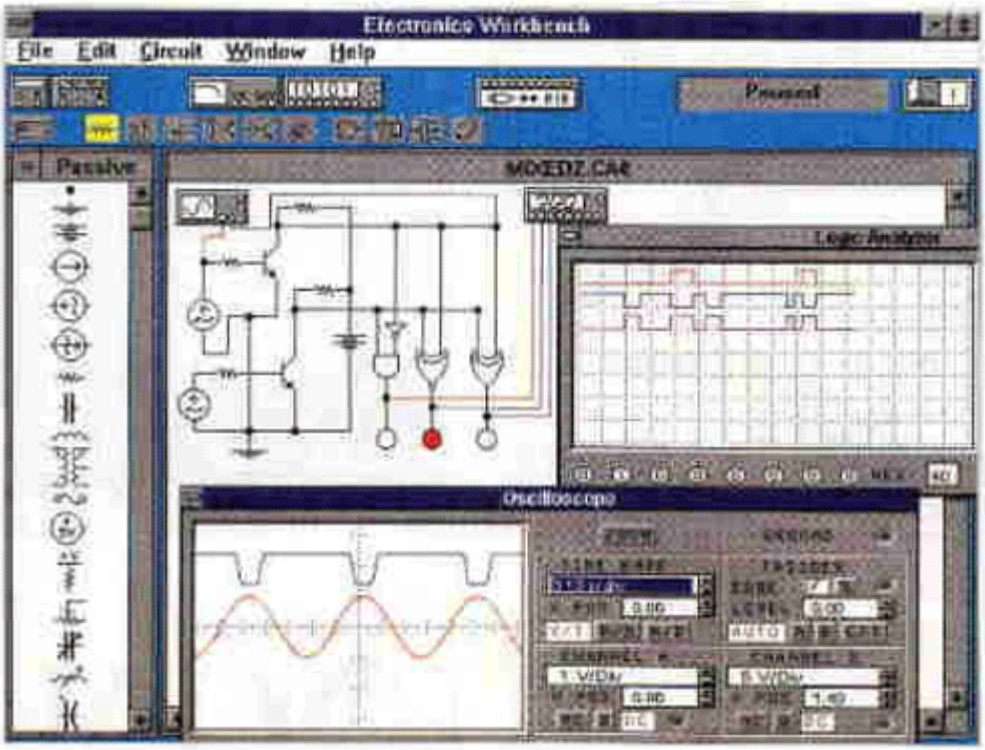
part 6 : optical applications -- analog

32. modulating an led
33. am transmission system
34. fm modulated carrier
35. fm carrier demodulation
36. pulse width modulation
37. pulse width demodulation
38. pulse code transmission
39. simplex and duplex systems

part 7 : reflective/transmissive applications

40. reflective/transmissive sensing
41. bar code wand

(EFT7)
circuit design training software



Item : Circuit Design Training Software

LABTECH now offers computerized circuit design training software to match it's printed circuit board based practical training programs. These programs are designed to complement our teaching systems and they allow the student to explore the circuit exercises with the aid of computer simulation. This will enhance the student's understanding of the lessons and strengthen his knowledge about circuit modification, theory, practical circuit applications and troubleshooting skills.

The circuit design training software utilizes the latest version of electronics workbench. This program enables the student to electronically explore sample circuits, modify designs, create new circuits as well as to test and measure the operational characteristics in simulation mode. Both analog, digital or mixed mode circuits (mixed analog & digital) can be simulated. the program includes a set of virtual instruments, which can be used to test the circuits signals and outputs. these instruments

include a digital auto ranging multimeter, dual trace oscilloscope, function generator, bode plotter and logic analyzer.

To complement the LABTECH trainers we have developed a special set of circuits that run under electronics workbench. These circuits match our electronic training systems and enable the student to simulate the exercises in a similar manner to the real PCB training circuit boards. Students can explore the circuits covered in the training program and can make numerous additional circuit modifications and measure the results. also special circuits are included that include fault simulation which challenge the students and develop their troubleshooting skills.

The following circuit sets are offered which match Labtech training systems:

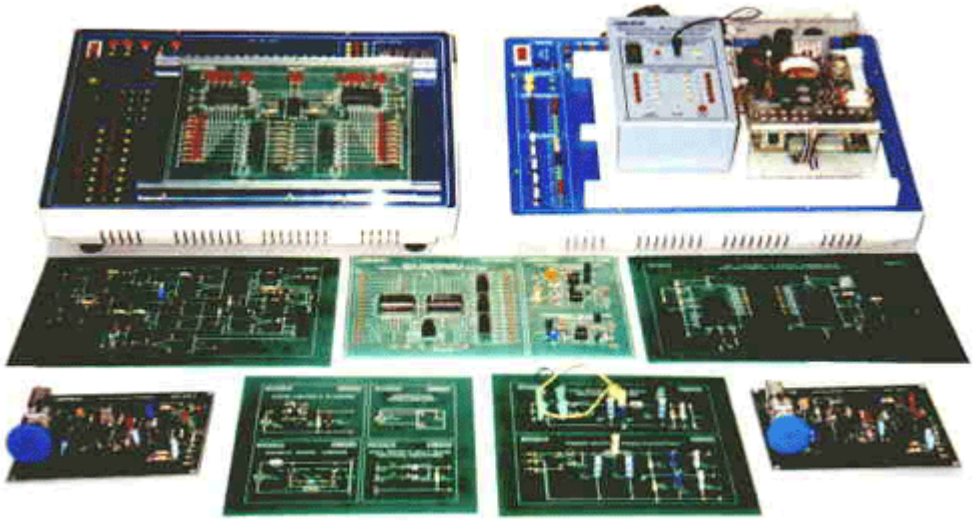
circuit sets for LABTECH trainers:

CDT-ELC basic electrical set matches the LABTECH trainer model EFT-ELC.
CDT-ETX basic electronics set matches the LABTECH trainer model EFT-ETX.
CDT-BEE fundamentals of electricity and electronics, matches the LABTECH trainer model EFT-BEE.
CDT-DTL digital electronics set matches the LABTECH trainer model EFT-DTL and EFT-DTA.
CDT-IPX industrial electronics set matches the LABTECH trainer model EFT-IPX.
CDT-RCT radio communications set matches the LABTECH radio trainers model ERT-RCT.
CDT-ATS audio electronics set matches the LABTECH audio trainers model EAV-ATS.

hardware and software systems:

CDT-EWB **electronic workbench software**: this is a circuit design and testing program ideal for creating and simulating the function of any circuits.
CDT-PCB **Super PCB**: this is a fully functional and easy to use printed circuit board design program. list of components can be down loaded from the circuits created in electronics workbench.
CDT-PRT **Laser Printer** to match the above system. this is useful for printing circuit designs, component lists and pcb design layouts.
CDT-PCS **Complete IBM Compatible Computer System** that is able to run our design software. Pentium processor, 3.5" floppy, 2.1 GB hard disk, 14" SVGA monitor, 16MB RAM.

(EFT8)
electronic applications boards



Item : electronics applications boards

LABTECH presents a series of electronics applications boards to extend and complement the capabilities of our analogue and digital electronics training systems. These boards offer the student sample functional circuits, which are applications of the theory, learned in the LABTECH electronics trainers. Each board comes with its own lab manual to guide the student through the exercises.

The modules can fit into our standard base stations. The base stations can also be ordered separately if desired.

ELECTRONICS APPLICATIONS BOARDS

1. Application Boards

EFT-EAB-1 AM Radio

EFT-EAB-2 FM Radio

EFT-EAB-3 Traffic light simulator

EFT-EAB-4A Power supplies fundamental

EFT-EAB-4B	Power supply troubleshooting
EFT-EAB-5	Switching power supply
EFT-EAB-6	Breadboard module
EFT-EAB-7	Digital switching network principle
EFT-EAB-8	Frequency to voltage converter
EFT-EAB-9	Voltage to frequency converter
EFT-EAB-10	USART module
EFT-EAB-11	Stepper motor & angular position module
EFT-EAB-12	DC motor and generator
EFT-EAB-13	AC motor and control
EFT-EAB-14	Basic Transducers - Thermal
EFT-EAB-15	Basic Transducers - Electromechanical
EFT-EAB-16	Basic Transducer - Optical
EFT-EAB-17	Transformers Module

2. base stations

EFT-ETB	basic electronics base station
EFT-BEB	electricity-electronics base station
EFT-DTB	digital electronics base station
EFT-IPB	industrial electronics base station

3. Experimentation Motors

EFT-EM1	DC motor, fractional HP
EFT-EM2	AC motor, fractional HP

(EFT9)

Laboratory Base Station

Item : Laboratory base Station

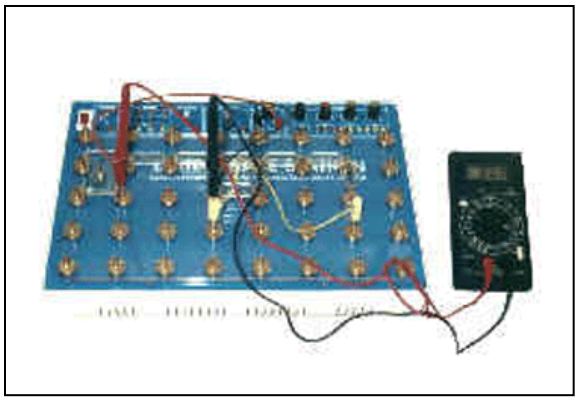
Model : EFT-LBS

The laboratory base station serves as the platform for carrying out the student experiments. The base station provide all primary needs of the experiment requirements such as power supplies, potentiometers, switches and data switches, clock generator, data display, speaker etc.

The laboratory base station is available in 3 models. each model has special features that are required by the component modules in order to perform the experiments.

1. basic electricity laboratory base station (EFT-LBS-1)

This base station is suitable for use with LABTECH basic electricity trainer. The base station contains a component matrix with 4 x 2mm socket in 40 positions onto which the discrete component modules can be mounted to build the required circuits. Other connections are made by 2mm and 4mm connecting leads. The base station also contains power supplies, potentiometers and speaker.

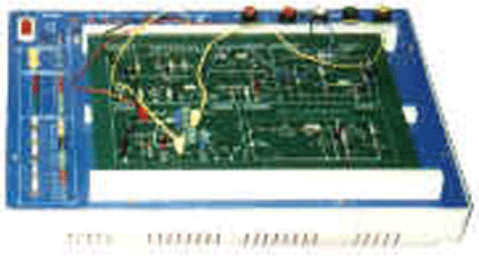


Specification :

1. fixed regulated dc power supplies : +5V, +15V, -15V
2. fixed ac power : +6V, -6V, +7.5V, -7.5V +9V, -9V, +12V, -12V
3. variable regulated dC power supply 0 - 25V
4. Potentiometers : 4 units
5. Speaker : 2.25 inch, 8 ohm/0.25W
6. One set of 2mm and 4mm stackable test leads to perform all required inter-connections.
7. Component circuit matrix board (to receive and connect component modules)

2. electronics laboratory base station (EFT-LBS-2)

This base station is suitable for use with LABTECH basic electronic trainer and kits modules. the base station utilizes a sliding mechanism that accommodates various size of modules. Connections are made by 2mm connecting leads. The base station also contains power supplies, potentiometers, switches, led indicators and speaker.

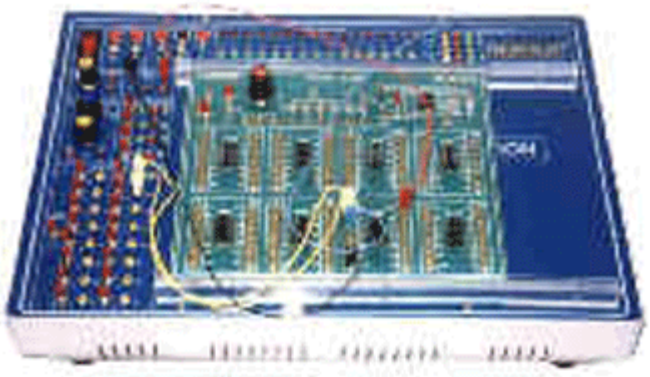


Specification :

1. fixed regulated dc power supplies : +5v, +15v, -15v
2. variable regulated dc power supply 0 - 25v
3. potentiometers : 4 units
4. pulse switches : 2 units
5. 8 bits led display.
6. toggle switches : 5 SPDT
7. speaker : 2.25 inch, 8 ohm/0.25w
8. one set of 2 mm stackable test leads to perform all required inter-connections.
9. one removable breadboard module

3. Digital Laboratory Base Station (EFT-LBS-3)

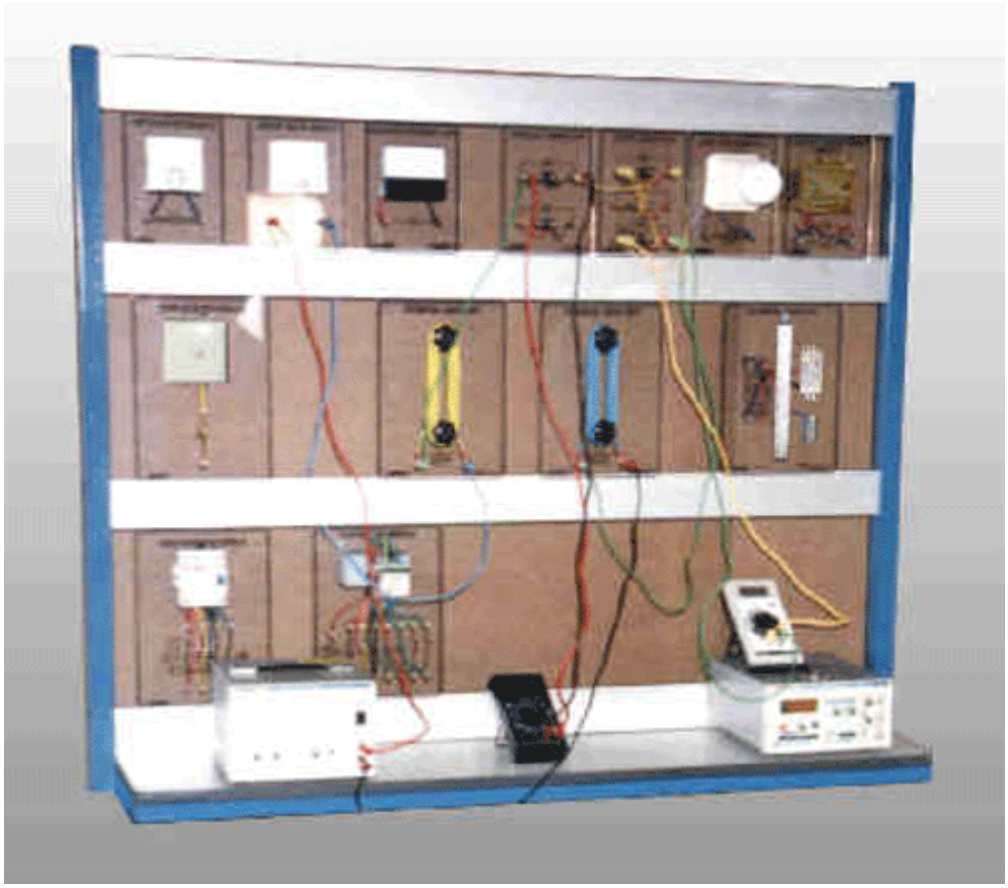
This base station is suitable for use with LABTECH digital trainer and application modules . The base station utilizes a sliding mechanism that accommodates various size of modules. connections are made by 2mm connecting leads. The base station also contains power supplies, logic indicators, data switches , switches, pulsers, seven segment displays and clock generator.



Specification :

1. power supply fixed : +5VDC, +15VDC, -15VDC, VARIABLE 1.5 ~15VDC
2. logic indicator : 16 logic indicators
3. data switch : 16 data switches (for TTL and CMOS)
4. toggle switch : 4 toggle switches (SPDT)
5. push button : 3 push buttons (2NO, 1NC)
6. pulser : 2 pulsers, (A,A and B, B)
7. seven segment : 4 seven segment digital displays.
8. clock generator : 1 Hz - 100 kHz
9. one set of stackable test leads to make all required inter-connections

(LFT1)
Basic Electrical Measurement



Item : Basic Electrical Measurement
Model : LFT-BEM-B (Bench Top Frame Type)
LFT-BEM-M (Mobile Frame Type)

The LABTECH Basic Electrical Measurement Trainer is ideal for learning the fundamentals of electrical measurement. The trainer provides a set of components modules which are specially designed fro performing all experiments of electrical measurements.

The experiments will guide the students in learning the theory and practical aspects of basic electrical measurements as well as the use of various instrumentation. The students are encouraged to explore the electrical circuit deeper by creating many different circuits which is possible because the modular components system allows the students to replace or add components individually.

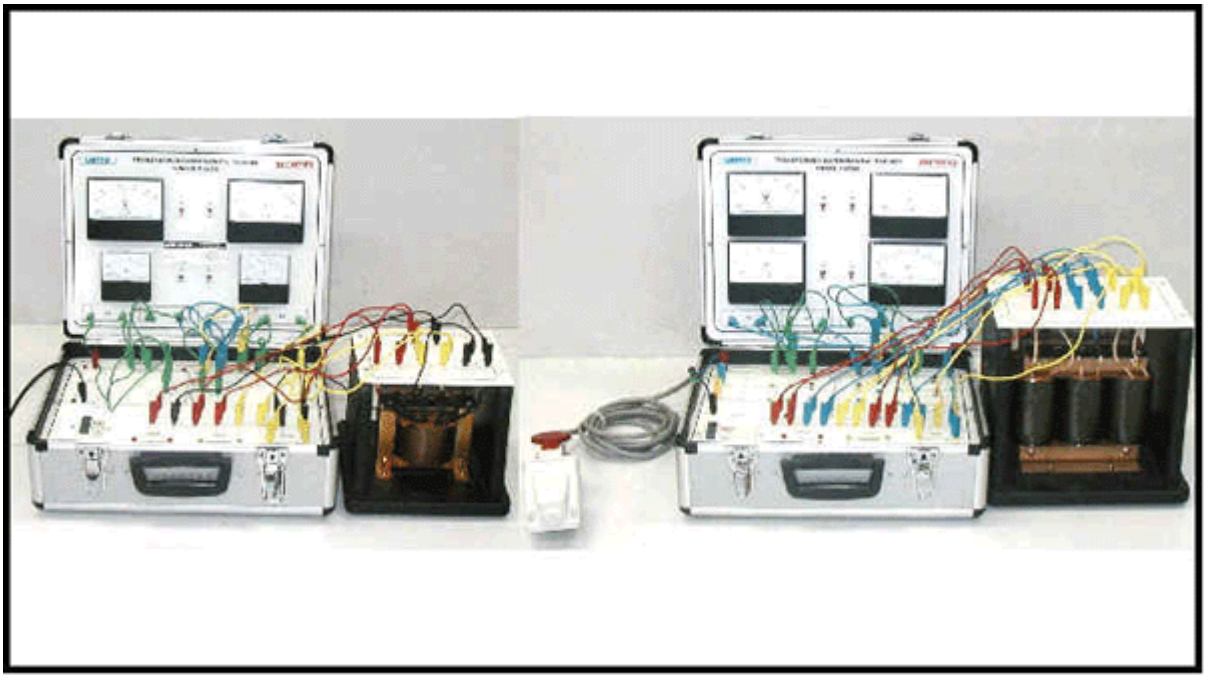
The trainer comes with a three level frame which accommodates three sizes of modules (A3, A4 and A5). The frame is available on a bench top type which is suitable for limited space like student laboratory workbench, and a mobile frame type which is designed for easy movement therefore it is suitable for demonstration purpose by the teachers.
The component modules are made from clear material with components symbol on them for easy reference. The connection between components are made by the means of flexible color coded jumper leads. Socket and plugs are in 4mm system.

LIST OF MODULES:

MODEL NO.:

MODEL : LFT-BEM-PS1: Variable AC Power Supply , 0 – 220V, 500W
MODEL : LFT-BEM-PS2: Three Phase Inverter Power Supply , 220V, 500W
MODEL : LFT-BEM-PS3: Variable DC Power Supply , 0 – 30V, 3A
MODEL : LFT-BEM-PS4: Static Rectifier, supply 220 V, 24V, DC output 24A
MODEL : LFT-BEM-PS5: Transformer unit: primary 120 – 220 V, secondary: 2 x 12V, 100 VA
MODEL : LFT-BEM-I1a: Voltmeter 0 – 5V DC
MODEL : LFT-BEM-I1b: Voltmeter 0 – 15V DC
MODEL : LFT-BEM-I1c: Voltmeter 0 – 50V DC
MODEL : LFT-BEM-I1d: Voltmeter 0 – 250V DC
MODEL : LFT-BEM-I1e: Voltmeter 0 – 600V DC
MODEL : LFT-BEM-I2a: Voltmeter 0 – 60V AC
MODEL : LFT-BEM-I2b: Voltmeter 0 – 150V AC
MODEL : LFT-BEM-I2c: Voltmeter 0 – 250V AC
MODEL : LFT-BEM-I2d: Voltmeter 0 – 600V AC
MODEL : LFT-BEM-I3a: Micro Ammeter 0 – 50 mic

(LFT2)
Transformer Experimental Trainer



Item : Transformer Experimental Trainer
Model : LFT-TET-P1 Single Phase Transformer Experimental Trainer
LFT-TET-P3 Three Phase Transformer Experimental Trainer

Today, almost every electrical and electronic products contain transformers which range in design and size from the small types used in audio frequency circuits to the large 3-phase transformers such as those used in power stations. Due to their widespread use and variation in design, studying transformers is an essential for any program involving electrical or electronic applications and electromagnetism. This course on transformers also provides good background theory and practice for the study of electrical machines.

The LABTECH LFT-TET Transformer Experimental Trainer is specially designed to help students understand about the various aspects in transformer design and operation such as magnetic fields and circuits, equivalent circuits, phasor diagrams, loss components, load testing and regulation, transformer components etc.

A comprehensive experiment manual is provided to guide the students on basic transformer theory and practice, and also provides a practical introduction to power supplies and electrical machines.

General Specification:

LFT-TET-B:
Base Station : This unit serves as the platform for carrying out student experiments. The unit contains two ammeters and two voltmeters which are used to do the voltage and current measurement during the experiments. A clear diagram of a transformer is shown on the base station and is completed with 4mm terminal connections to build transformer circuits. Circuit protection is provided to prevent short circuit and over current conditions.

- Power requirement : 220V/380V, 50/60Hz
- Dimension approximately: 40 x 30 x 15cm (L x W x H)
- Weight : ± 1Kg

LFT-TET-P1A:
Single Phase Transformer :
- Primary : 220 V/0.5A
- Secondary : 0-12 V/12A, 0-24/6A, 0-42V/3A

LFT-TET-P1B:
Single Phase Transformer :
- Primary : 220V/0.5A
- Secondary : 2 x 110/5A

LFT-TET-P3:
Three Phase Transformer :
- Primary : 380 V/1kW, 3 phase
- Secondary : 0-380V, 3 phase
- Machines and brakes including the control unit are suitable for operation in all three power range 100W, 300W and 1000W with this trainer.

Experiment topics :
- Polarity of windings
- Series and parallel connection of secondary windings
- Magnetic circuits, incorporating the concept of flux, flux density, field strength, magneto motive force.
- Phasor diagram with transformer on no-load
- Equivalent circuit of power transformer
- Transformer efficiency using open and short circuit test
- Full load test showing temperature rise and efficiency
- Voltage regulation using open and short circuit tests
- Current transformer
- Delta and Y connection (EFT-TET-3 only)

Accessories :
- Experiment manual
- 1 Set of test leads

Optional Items for Single Phase Transformer Experimental Trainer LFT-TET-1 :
LFT-TET-01 Load unit consists of variable resistor banks
LFT-TET-02 Variable power supply 0-250 V/3 A, source 220 V, single phase, 50/60Hz
LFT-TET-03 Bridge rectifier module, 25 A, 250 V max.
LFT-TET-04 Wattmeter to do the power measurement
LFT-TET-05 External thermomagnetic circuit breaker for additional protection.

Optional Items for Three Phase Transformer Experimental Trainer LFT-TET-3 :
LFT-TET-06 Three phase load unit
LFT-TET-07 Variable three phase power supply, 0-380/1 kW
LFT-TET-08 Three phase rectifier module

LFT-TET-09 Three phase Wattmeter
LFT-TET-10 External thermal overload module

(LFT3)
Fundamental of Appliance Repair Trainer

Item : Fundamental of Appliance Repair Trainer
Model : LFT-ART

The LABTECH Fundamentals of Appliance Repair Trainer is designed to provide students with strong foundation of Electrical Technology that is used in Electrical Appliances. This trainer provided a good background theory on electrical as well as the troubleshooting and repair technique for most of electrical appliances. The experiments are focused on essential area within electrical technology that is related to electrical appliances repair.

The trainer consists of several modules which feature electrical and electronic components that are mounted onto high quality boards with the circuit symbols diagram silk-screened onto the surface. Inter-connections between key components or circuit blocks are provided through 4 mm color coded sockets and test leads. This will allow the students to do the wiring quickly and with many variations, so that the learning will become more interesting and effective.

A mobile stand is provided for holding the module boards during experimentation and is completed with power supply connection and necessary accessories for doing the experiments.

Specifications:

Mobile Stand:

This is a 3 levels stand including shelves that serve as the platform for carrying out student experiments. The modules feature real industrial components mounted onto 5mm transparent Plexiglas panels that easily and securely fit into the training panel frames. Panels can be quickly arranged in various configurations so as to conduct many experiments. Panels are A4, A5 or A6 in size and feature the electrical circuit diagram silk-screened onto the surface of each panel. All electrical connections for each component are brought out to 4mm color-coded heavy-duty binding posts. Wiring from the component to the terminals is also color-coded so as to enhance the student learning experience. Interconnections between the panels and components are made via 4mm stackable test leads. Stackable test leads allow multiple connections from a single point, which is very useful when taking electrical measurements. Therefore the student is able to relate the circuit theory with the practical aspects of the real component and actual wiring connections.

Experiment Topics:

- Using meters for troubleshooting
- The importance of Power Factor
- Basic AC circuits examples
- Electricity and Heat
- Determining the length of Resistance Wire
- Incandescent Lamps
- Fluorescent Lamps
- Starting Methods
- Switches in Lamps
- Servicing Lamps

- Electricity and transmission of Power
- Transformers
- Servicing by Substitution
- Using Test Lamps
- Servicing with Test Instruments
- Voltage Tests
- Open Circuits
- Checking Line Voltages
- Testing Special Circuits

Accessories:

- Student Experiment Manual
- Set of stackable test leads.

(LFT4)
Electrical Appliance for Education

Item : Electrical Appliance for Education

LABTECH Electrical Appliances for Education are designed to meet the requirement on practical aspect of learning Electrical Appliances Repair. The appliances are chosen from famous brand of electrical appliance manufacturers such as Philips, National, Hitachi, etc. The appliance models are provided in operational type (O) and sectioned type (S) and it is specially made for educational purposes. The operational type (O) of appliances are designed for the students to practice on assembling and disassembling and also to learn the operating principle of each device. Each device is fully operable and come with operating instruction as well as the technical specification. The sectioned types (S) of appliances are designed for learning about component identifications and functions. All key components are carefully sectioned and painted with standardize color paint to provide a clear distinct able view on components layout. A component identification list is provided to help the students in finding the related components.

The electrical appliances will be an ideal choice for teaching Electrical Appliance Repair and also be a good combination for the LABTECH Fundamentals of Electrical Appliance Repair Trainer. Training set (T) are also provided which consist of are sectioned unit. One operable unit and student exercise manual.

Specifications:

1 Electrical Iron, 220VAC, ± 300 Watt with automatic control

Model LFT-EAA-O (Operable)
LFT-EAA-S (Sectioned)
LFT-EAA-T Training Set

2 Automatic Electric Kettle, 220 VAC,

± 350 Watt

ModelLFT-EAB-O (Operable)

LFT-EAB-S (Sectioned)

LFT-EAB-T Training Set

3 Blender, 220VAC, 400 Watt with double speed function

ModelLFT-EAC-O (Operable)

LFT-EAC-S (Sectioned)

LFT-EAC-T Training Set

4 Electrical Toaster, 220VAC, 220 Watt, 50Hz

ModelLFT-EAD-O (Operable)

LFT-EAD-S (Sectioned)

LFT-EAD-T Training Set

5 Rice Cooker, 220VAC, 600 Watt, and 50Hz with automatic keep warm function

ModelLFT-EAE-O (Operable)

LFT-EAE-S (Sectioned)

LFT-EAE-T Training Set

6 Vacuum Cleaner, 220VAC, and 750 Watt

ModelLFT-EAF-O (Operable)

LFT-EAF-S (Sectioned)

LFT-EAF-T Training Set

7 Hair Dryer, 220VAC, 350 Watt, 50Hz

ModelLFT-EAG-O (Operable)

LFT-EAG-S (Sectioned)

LFT-EAG-T Training Set

8 Electrical Oven, 220VAC, ± 800 Watt, 50Hz

ModelLFT-EAH-O (Operable)

LFT-EAH-S (Sectioned)

LFT-EAH-T Training Set

9 Washing Machine, 220 VAC, ± 600 Watt

ModelLFT-EAI-O (Operable)

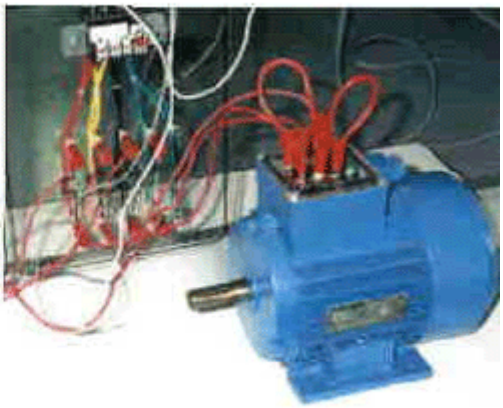
LFT-EAI-S (Sectioned)
LFT-EAI-T Training Set

10 Electric Drill, 220VAC, ± 350 Watt
Model LFT-EAJ-O (Operable)
LFT-EAJ-S (Sectioned)
LFT-EAJ-T Training Set

11 Sewing Machine, 220VAC, 50Hz, ± 125 Watt
Model LFT-EAK-O (Operable)
LFT-EAK-S (Sectioned)
LFT-EAK-T Training Set

12 Electric Fan, 220VAC, 50Hz, ± 100 watt with three speed control and timer
Model LFT-EAL-O (Operable)
LFT-EAL-S (Sectioned)
LFT-EAL-T Training Set

(LEW1)
basic electrical technology trainer



Item : Basic electrical technology trainer

The LABTECH "basic electrical technology trainer" is designed to provide students with a good foundation in electrical technology, and to prepare them for a career as an installation/service technician. This system is designed to give a general program on the basics of electrical installation and motor control. It is a good all round combination program. For more in-depth studies the LEW-EIT electrical installation trainer and the LEM-MCF motor control circuit trainer can be used.

Each module contains real industrial electrical components that are mounted onto clear plexiglass panel modules. Each panel has the electrical connections brought out to 4mm color coded binding posts. Connections between the components or between the modules are made by using 4mm stackable test leads. The panel modules can be easily arranged and configured for experiments in the panel frame stand. This system allow the students to do the wiring quickly and with many variations, so that the learning will become more interesting and effective.

The trainer comes complete with a laboratory manual, which contains many experiments on basic electrical technology. Bench top or mobile training frame stands are available to mount the panels. Also storage cabinets can be added to provide a convenient place to store the panel modules.

basic electrical technology trainer - list of panel modules

The modules feature real industrial components mounted onto 5mm transparent plexiglas panels that easily and securely fit into the training panel frames. Panels can be quickly arranged in various configurations so as to conduct many experiments. Panels are a4, a5 or a6 in size and feature the electrical circuit diagram silk-screened onto the surface of each panel. All electrical connections for each component are brought out to 4mm color-coded heavy-duty binding posts.

Wiring from the component to the terminals is also color-coded so as to enhance the student learning experience. interconnections between the panels and components are made via 4mm stackable test leads. Stackable test leads allow multiple connections from a single point, which is very useful when taking electrical measurements. Therefore the student is able to relate the circuit theory with the practical aspects of the real component and actual wiring connections.

Fault insertion option is available for troubleshooting exercises. Any panel module can be ordered so as to be fitted with hidden switches that will introduce electrical faults. to order this option add an "f" onto the panel module numbers (i.e. lew-bet-a1f).

	no. of units		no. of units
a. circuit breakers:		**d. contactors and controls:**	
LEW-BET-A1: NFB (no fuse breaker) module, 32 Amps	1	LEW-BET-D1: contactor module, three phase, with 1 NO and 1 NC	4
LEW-BET-A2: single phase MCB module, 10 Amps	1	auxiliary contact	1
LEW-BET-A3: three-phase MCB module, 16 Amps	1	LEW-BET-D2: thermal overload relay, 3 phase current adjusting	1
LEW-BET-A4: single phase ELCB module	1	LEW-BET-D3: timer module, 3 phase,0 to 60 seconds	1
LEW-BET-A5: three-phase ELCB module	1	LEW-BET-D4: control relay: 220 VAC, 2 NO 2 NC	1
		LEW-BET-D5: push button module, set of 2, 1 no 1 NC	2
b. electrical sockets:		LEW-BET-D6: rotary selector switch,4 position	1
LEW-BET-B1: single phase socket module with switch and plug	1		
LEW-BET-B2: three phase industrial socket with plug	1	**e. electrical motors:**	
		LEW-BET-E1: induction motor, single phase, 220VAC, 1 HP(.75kW)	1
c. electrical switches:		LEW-BET-E1: induction motor, 3 phase, 380VAC, 1HP (.75kW)	1
LEW-BET-C1: switch,surface mount, 1 way, 2 terminal, 10A	1		
LEW-BET-C2: switch,surface mount, 2 way, 3 terminal, 10A	1	**f. electrical instrumentation and accessories:**	
LEW-BET-C3: switch,surface mount, 2	2	LEW-BET-F1: incandescent	2

way, 4 terminal, 10A		lamp holder with bulb, E27, 220V	
LEW-BET-C4: switch,surface mount, intermediate, 10A	2	LEW-BET-F2: pilot lamp panel with 3 lights	1
LEW-BET-C5: selector switch for 3 phase current measurement	1	LEW-BET-F3: mains input panel for single and three phase	1
LEW-BET-C6: selector switch for 3 phase voltage measurement	1	LEW-BET-F4: set of stackable 4mm connection test leads	set
		LEW-BET-F5: ampere meter: 0 to 5 Amps	1
		LEW-BET-F6: ampere meter: 0 to 20 Amps	1
		LEW-BET-F7: voltmeter: 0 to 500 VAC	1
		g. training panel frame:	
		LEW-BET-G1: three level mobile frames with 4 rails	1

Optional items:

Additional meters can be ordered as extra accessories to enhance the measurement capabilities, see our electrical instrumentation brochure for the details.

Storage cabinets are available for safe and secure storage of the panel modules. LPS-SCP-2 double door storage cabinet with slots to accommodate the panels.

complete set configurations:

For easy ordering you can use the following models numbers which will order the complete system that includes all of the panel modules. Both systems include the three level mobile frames for mounting the panels. The second system below also includes the storage cabinet.

LEW-BET-T complete set of panel modules with three level mobile frame.
LEW-BET-S complete set of panel modules with three level mobile frame and double door storage cabinet.

(LEW2)
electrical installation trainer

Item : electrical installation trainer
Model : EW-EIT

The LABTECH "electrical installation trainer" is designed to provide students with a good foundation in electrical technology, and to prepare them for a career as an installation/service technician. The system consists of a number of modules which are suitable for the study of electrical measurement, electrical installation and for the troubleshooting of electrical installations

Each module contains real electrical components such as contactors, switches, lamps, push buttons, timers, circuit breakers and relays. These modules can be arranged on the panel frame stand in a variety of configurations to make many different and interesting installations. Connections between the components or between the modules are made by using 4 mm test leads which plug into 4mm color-coded heavy-duty binding posts. This will then allow the students to do the wiring quickly and with many variations, so that the learning will become more interesting and effective.

The trainer comes complete with laboratory manual which contains many experiments on electrical installation technology. Bench top or mobile training frame stands is available to mount the panels. Also storage cabinets can be added to provide a convenient place to stove the panel modules.

electrical installation trainer - list of panel modules

The modules feature real industrial components mounted onto 5mm transparent plexiglas panels that easily and securely fit into the training panel frames. Panels can be quickly arranged in various configurations so as to conduct many experiments. Panels are A4, A5 or A6 in size and feature the electrical circuit diagram silk-screened onto the surface of each panel. All electrical connections for each component are brought out to 4mm color-coded heavy-duty binding posts. Wiring from the component to the terminals is also color-coded so as to enhance the student learning experience. Interconnections between the panels and components are made via 4mm stackable test leads. Stackable test leads allow multiple connections from a single point, which is very useful when taking electrical measurements. Therefore the student is able to relate the circuit theory with the practical aspects of the real component and actual wiring connections.

Fault insertion option is available for troubleshooting exercises. Any panel module can be ordered so as to be fitted with hidden switches that will introduce electrical faults. To order this option add an "f" onto the panel module numbers (i.e. LEW-EIT-A1F).

a. residential switches:	**No. of Unit**	**e. lights and fixtures**	**no. of unit**
Mounted on plexiglass panel with 4mm 1terminals		To include matched lamp holders complete with lamps mounted onto plexiglass panels with 4 mm terminals	
LEW-EIT-A1: switch surface mount, 2 way, 2 terminal, 10A, 1 gang	4	LEW-EIT-E1: incandescent lamp holder with bulb, E27, 220V	4
LEW-EIT-A2: switch surface mount, 2 way, 3 terminal, 10A, 1 gang	4	LEW-EIT-E2: incandescent lamp holder with bulb, E27, 220V	4
LEW-EIT-A3: switch surface mount, 2 way, 4 terminal, 10A, 1 gang	4	LEW-EIT-E3: fluorescent lamp holder with starter and ballast, 10W	2
LEW-EIT-A4: switch surface mount, intermediate, 10A, 1 gang	4	LEW-EIT-E4: fluorescent lamp holder with starter and ballast, 20W	2
LEW-EIT-A5: switch surface mount, 1 way, 2 terminal, 10A, 1 gang	2	LEW-EIT-E5: mercury lamp holder with lamp	1
LEW-EIT-A6: switch surface mount, 2 way, 3 terminal, 10A, 2 gang	2	LEW-EIT-E6: pilot signaling lights, 24VAC, set of three (red, yellow, green)	1
LEW-EIT-A7: switch surface mount, 2 way, 4 terminal, 10A, 2 gang	2		
LEW-EIT-A8: switch surface mount, marked "bell"	2	**f. controls and components:**	
LEW-EIT-A9: switch surface mount illuminated	2	LEW-EIT-F1: control transformer, input 220VAC, output 6/12/24VAC	2

LEW-EIT-A10: switch surface mount dimmer	2	LEW-EIT-F2: control relay: 24 VAC, 2NO 2NC	2
LEW-EIT-A11: switch surface mount, 1 way, 3 terminal, 10A	2	LEW-EIT-F3: control relay: 220VAC, 2NO 2NC	**2**
LEW-EIT-A12: switch ceiling pull type, 1 way, 3 terminal, 10A	1	LEW-EIT-F4: timer: 24 hours	1
		LEW-EIT-F5: door bell, 12VAC	1
b. sockets sets:		LEW-EIT-F6: buzzer, 12VAC	
To include the sockets mounted onto plexiglass panel with 4mm terminals, each socket is to include a matching plug			
LEW-EIT-B1: 1 phase socket with switch, 13A, 3 prong, 1 gang	3	**g. measuring instruments:**	
LEW-EIT-B2: 1 phase socket with switch 13A, 2 prong, 1 gang	2	LEW-EIT-G1: mains input panel for single and three-phase	1
LEW-EIT-B3: 1 phase socket with switch, 16A, 1 gang	5	LEW-EIT-G2: set of stackable 4mm connection test leads	**set**
LEW-EIT-B4: 1 phase industrial socket, with cover, 16A, 2 pole & earth	2	LEW-EIT-G3: ampere meter: 0 to 20 Amps	1
LEW-EIT-B5: 3 phase industrial socket, with cover, 16A, 2 pole with neural & earth	2	LEW-EIT-G4: voltmeter: 0 to 500VAC	1
LEW-EIT-B6: 1 phase cee, 16A, 3 round prong	2	LEW-EIT-G5: ampere meter: 0 - 5Amps	1
c. electrical switches:		**h. telephone/intercom modules:**	
LEW-EIT-C1: toggle switch	4	LEW-EIT-H1: door phone signaling board	1
LEW-EIT-C2: push button, 1 NO 1 NC	2	LEW-EIT-H2: master phone/intercom (2 rooms + door station + buzzer)	1
LEW-EIT-C3: camswitch, on/off	2	LEW-EIT-H3: sub station phone/intercom	**2**
LEW-EIT-C4: selector switch (for 3 phase amperage measurement)	1	LEW-EIT-H4: signaling push button (maid/porter/valet)	1
LEW-EIT-C5: selector switch for 3 phase voltage measurement	1	LEW-EIT-H5: electric door lock 12V	1
LEW-EIT-C6: stepping relay for sequencing; 2 SPST switches with 4 sequencing:	1		
LEW-EIT-C7: latching relay: 2 relays with bistable operating contacts, coil, 24 VAC, 3 contacts, 48 VAC, 2A	1	**i. training panel frames:**	
		LPS-TPF-4: three level mobile frames with 4 rails height: 1850mm, width: 1100mm	
d. circuit breakers			1
LEW-EIT-D1: MCB, 1 phase, 10A	5		
LEW-EIT-D2: MCB, 1 phase, 16A	2		
LEW-EIT-D3: MCB, 3 phase, 16A	1		
LEW-EIT-D4: ELCB, 1 phase	1		
LEW-EIT-D5: ELCB, 3 phase	1		
LEW-EIT-D6: NFB, 1 phase	1		

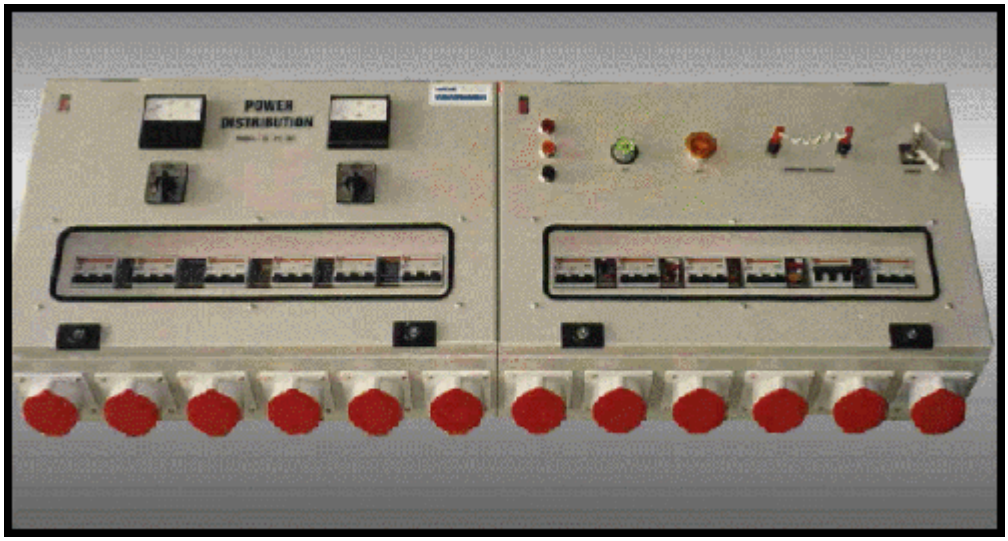
optional items:
Additional meters can be ordered as extra accessories to enhance the measurement capabilities, see our electrical instrumentation brochure for the details.

Storage cabinets are available for safe and secure storage of the panel modules. LPS-SCP-2 double door storage cabinet with slots to accommodate the panels.

complete set configurations:
For easy ordering you can use the following models numbers which will order the complete system that includes all of the panel modules. Both systems include the three level mobile frames for mounting the panels. The second system below also includes the storage cabinet.

LEW-EIT-T complete set of panel modules with three level mobile frame.
LEW-EIT-S complete set of panel modules with three level mobile frame and double door storage cabinet.

(LEW3)
power distribution board



Item : power distribution board
model : LEW-PDB

The LABTECH power distribution board is specifically designed to suit the needs of electrical laboratory systems. Safety aspects are designed into the system with high quality components throughout for safeguard and protection to the operator. The unit allows wide flexibility to change the number of circuit breakers and receptacles according the needs. The systems include a range of 4 up to 12 receptacles, each with its own circuit breaker, that allow the user to connect electrical equipment directly to the board. this on-board design consolidates all the essential components

into an easy to understand and operate system. the design allows for extension boards to the bus bar if needed.

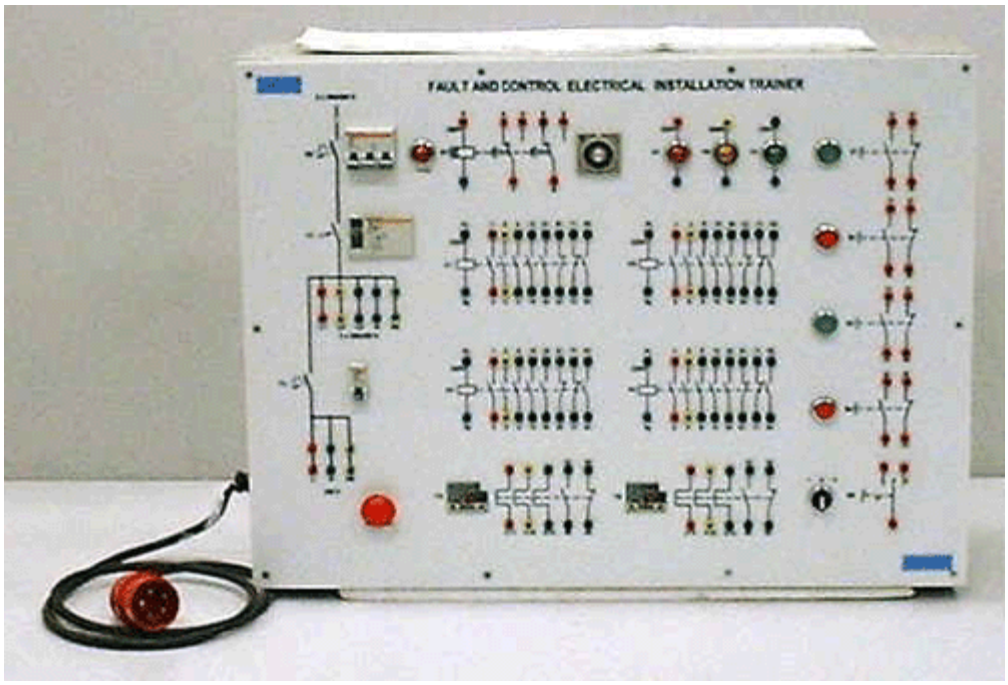
The number of circuit breakers, receptacles, bus bars can be specially ordered for custom requirements. in addition, components such as transformers or additional electrical meters, such as frequency meters or power factor meters, can be added to the system.

The unit is equipped with a voltmeter and ammeter to monitor the voltage and current in the lines. A direct-on-line push button start/stop switch is provided for mains power control with safeguarded easy operation.

General Specification :

- 1 air circuit breaker 100/600A
- overload and shunt trip coil
- 1 ammeter 100A/5A with selector switch
- 1 voltmeter 500V with selector switch
- 1 earth fault relay (ELCB)
- 1 frequency meter
- power factor meter
- 1 maximum demand indicator
- 2 emergency stop button
- 1 kWh meter, 3 phase
- 1 kWh meter, 1 phase
- 4 circuit breaker, 32A, three phase
- 4 circuit breaker, 6A, single phase
- 4 output socket, 5 pin (3 phase)
- 4 output socket, 3 pin (single phase)
- 1 set protective fuse
- 1 set copper bus bar 0.25 inch x inch
- 1 set indicator lights
- 1 set current transformer
- 1 set input socket, plug and cable
- 2 compartments for storing made by heavy sheet steel finished baked epoxy powder with engrained and silk screen legend.
- operation manual.

(LEW4)
electrical circuit fault trainer



item : electrical circuit fault trainer
model : LEW-ECF (CIRCUIT FAULTS)

The LABTECH "electrical circuit fault trainer" is designed to provide a course on the operation and troubleshooting for electrical control circuits. It has unique control training capabilities with a fault insertion system which is useful as a teaching aid in fault finding or troubleshooting the electrical installation.

This unit consists of various real industrial components that are common to electrical installation and control circuits. These components are mounted onto a training display board and their electrical connections are brought out to 4mm terminals. During the student exercises connections are made by test leads, which gives the student through the experiments, and provides the necessary theoretical background to allow students to successfully complete the educational objectives. topics include: varieties of contactors, thermal overload, typical electrical connections and wiring diagrams, motor control for star (WYE) connections, motor control for delta connections, fault finding and troubleshooting.

Connections between the components are made by using stackable 4mm test leads which plug into 4mm color-coded heavy-duty captive-head binding posts. Each component is equipped with up to four faults by using fault-insertion switches. A total of 30 faults are provided.

technical specifications:

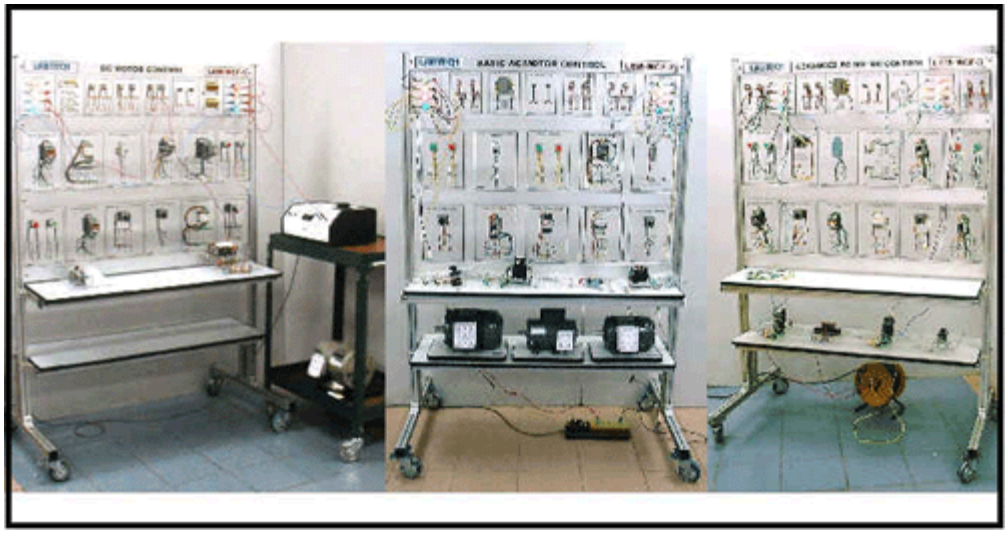
Components are mounted onto a panel display which can be used on top of any workbench. Electrical connections for each component are brought out to 4mm terminals. Faults are provided on each major component and fault switches are easily accessible

	list of components	**qty**
1	main MCB 3 phase 16A (miniature circuit breaker)	1
2	control MCB 6A, 1 phase (miniature circuit breaker)	1
3	ELCB 3phase (earth leakage circuit beaker)	1
4	control lamp to indicate "on"	3
5	magnetic contactor + auxiliary contacts (2NO + 2NC) 220V	4
6	push button switches, NO/NC	4
7	regulated cam switch, i-o-ii	1
8	thermal overload relay 1-1.6A	2
9	time delay relay 0-10sec	1
10	push button switch for emergency off "off"	1
11	illuminated power lamps	1
12	fault switches	30

general information:

- power supply : 3 x 380v
- rate current : 16a
- output voltage : 220v/ 3 x 380v
- output : 4mm heavy-duty binding post
- overload protection provided
- dimensions : 60cm x 80cm x 25cm (h x w x d)

(LEM1)
Motor Control Circuit Trainer



Item	**:**	**Motor Control Circuit Trainer**
Model	**:**	**LEM-MCF-1DC Motor Control**
		LEM-MCF-2 Basic AC Motor Control
		LEM-MCF-3 Advanced AC Motor Control

This trainer provides a good grounding in mastering control technology using various types of electrical contactor circuits. The trainer features modular components are mounted onto a rack system to facilitate the setting up of various types and configurations of circuits.

This system allows the students to select the module and design their own wiring on various contactor circuits. The student is also introduced to popular motor control circuits, such as a reversing circuit with various interlocking circuits, star-delta circuits, pole switching circuits for separate winding, Dahlander Circuits for two speed rotation, jogging, plugging and many other common circuits such as direct on/off switching, monitor lamp operation, fault indication and switching from two locations via a sequential circuit. a student/teacher manual, which covers technical explanations, is provided together with student job sheets.

The 3 level workstation is available as a bench top or mobile unit and accommodates up to four students. The three level rails system holds the modules firmly in place. Connections between the components are made by using stackable 4 mm test leads, which plugs into 4 mm color-coded heavy-duty captive-head binding posts. This will allow the students to make quick and precise connections.

Technical Specifications:

The modular electrical contactor motor control training system uses real industrial components mounted in modular panels. A two level work frame is provided for use by the module to make various configurations.

Electrical modules: sets of modules are provided to carry out the experiments including contactors, switches, thermal overload relays, circuit breakers, transformers and indicator lamps as detailed below.

List of modules:

A. LEM-MCF-1 DC MOTOR CONTROL

1. DC Magnetic Contactor (2 modules)
2. Miniature Circuit Breaker, 3-phase (1 module)
3. Thermal Overload, 3-phase 0-20 a (1 module)
4. Control Transformer (1 module)
5. Control Relay 2NO-NC (2 modules)
6. DC Control Relay (1 modules)
7. Push Button NO-NC, set of 2 (2 modules)
8. Selector Switch (1 module)
9. Reversing Starter (1 module)
10. Motor Control Switch (1 module)
11. Indicator Lamp, set of 4 (2 modules)
12. Toggle Switch DPDT, set of 2 (3 modules)
13. Motor Starter (1 module)
14. Time Delay (1 module)
15. Resistor Module (2 modules)
16. Field Rheostat (1 module)
17. DC Power Supply, 0-220 VDC (1 module)
18. Manual Starter (1 module)
19. set of test leads

B. LEM-MCF-2 Basic AC Motor Control

1. Magnetic Contactor, 3-phase with auxiliary contact NO-NC (2 modules)
2. Miniature Circuit Breaker, 3-phase (1 module)
3. Thermal Overload, 3-phase 0-20 a (1 module)
4. Control Transformer (1 module)
5. Control Relay 2NO-NC (1 module)
6. Push Button NO-NC, set of 2 (2 modules)
7. Limit Switch NO-NC (1 module)
8. Selector Switch (1 module)
9. Reversing Starter (1 module)
10. Motor Control Switch (1 module)
11. Indicator Lamp, set of 4 (2 modules)
12. Toggle Switch DPDT, set of 2 (3 modules)
13. Manual Starter (1 module)
14. Time Delay Relay (1 module)
15. set of test leads

C. LEM-MCF-3 Advanced AC Motor Control

1. Magnetic Contactor, 3-phase with auxiliary contact NO-NC (4 module)
2. Miniature Circuit Breaker, 3-phase (1 module)
3. Thermal Overload, 3-phase 0-20 a (1 module)
4. Control Transformer (1 module)
5. Control Relay 2no-2nc (1 module)
6. Push Button NO-NC, set of 2 (2 modules)
7. Limit Switch NO-NC (1 module)
8. Selector Switch (1 module)
9. Star-Delta Switch (1 module)
10. Reversing Starter (1 module)
11. Motor Control switch (1 module)
12. Indicator Lamp, set of 4 (2 modules)
13. Toggle Switch DPDT, set of 2 (3 modules)
14. Time Delay Relay (1 module)
15. Photo Electric Sensor (1 module)
16. Proximity Switch (1 module)
17. Solid State Relay (1 module)
18. set of test leads

- Courseware for student and instructor provided on general information and fault finding in contactor circuits, including job sheets (available in Indonesian and English languages)
- Three level frame (either bench top or mobile)
- Continuity and voltage tester
- Set of connection leads

General Information:

- Power Supply : 3 x 380 V
- Current Rate : 16 A
- Control Voltage : 24 V/220 V
- Outputs : 4 mm heavy duty binding post, panel type
- Dimensions : **LEM-MCF-M**, mobile frame
  LEM-MCF-B, bench top frame

D. LEM-MCF-4 Complete System for Motor Control Training

Consists of an entire set of modules for:

LEM-MCF-1	dc motor control
LEM-MCF-2	basic ac motor control
LEM-MCF-3	advanced motor control
LPS-SCP-2	storage cabinet for modules
	set of four motors as per "section e recommended motors" below

E. Recommended Motors

These motors are required as the minimum for conducting the experiments for these trainers.

	Motor Models	Required for These Trainers
1. DC compound 0.75 kW	(LEM-EMS-3-0.75)	MCF-1 ,MCF-4
2. AC induction motor, 1 phase, 0.75 kW	(LEM-EMS-4-0.75)	MCF-2,MCF-4
3. AC induction motor, 3 phase, 0.75 kW	(LEM-EMS-8-0.75)	MCF-2, MCF-3, MCF-4
4. AC induc. pole changing motor 0.75 kW	(LEM-EMS-9-0.75)	MCF-3, MCF-4

(LEM2)
motor-generator system

Item : motor-generator system
Model : LEM-MGS

The LABTECH motor-generator system is an integrated system for in depth studies or motor-generator theory and working principles. The system comes mounted on its own base plate with an upright control panel and the motor-generator combination is connected via a flexible coupling. The control panel comprises of

voltmeter, ampere meter, and all wiring connections brought out to 4mm terminals. Connection leads with banana plugs facilitate quick and easy connections between the motor-generator system and other controls.

The motor and generator can be set-up independently, besides in conjunction with each other, for in-depth studies on each individual unit. An operation manual and experiment manual is provided in English.

Llist of Generators :	**power 1 hP**	**Rating 1.5 HP**	**2 HP**
1. AC Generator Single Phase	**LEM-MGS-G1A**	**LEM-MGS-G1B**	**LEM-MGS-G1C**
2. AC Generator Three Phase	**LEM-MGS-G2A**	**LEM-MGS-G2B**	**LEM-MGS-G2C**

List of Motors :

1. single phase induction motor	**LEM-MGS-M1A**	**LEM-MGS-M1B**	**LEM-MGS-M1C**
2. three phase induction motor	**LEM-MGS-M2A**	**LEM-MGS-M2B**	**LEM-MGS-M2C**

Power ratings above the specifications listed are available upon request. For example, LEM-MGS-G1-4KW signifies an AC generator single phase with output of 4 kilowatts (kW).

specifications:

generator: (LEM-MGS-G2B)
- Speed: 1500 rpm
- Power: 1.0 kVA
- Voltage: 220/380 V
- Frequency: 50 Hz

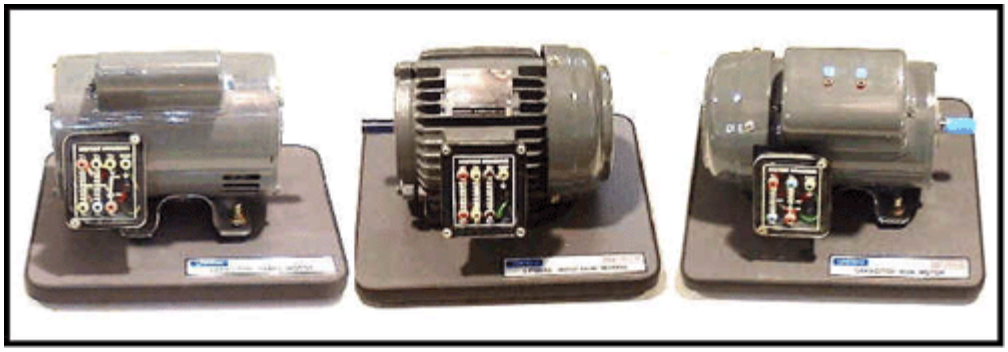
Motor: (LEM-MGS-M2B)
- Speed: 1500 rpm
- Power: 1 kW
- Current: 3A/220 V
  2A/380 V
- Voltage: 220 V/380 V
- Torque: Max. 20 nm (measured with Lem-Dyn1 Dynamometer).

Accessories:
- Control panel with ammeter, voltmeter, start-stop button and overload protection.
- Power supply 220/380 v, 3 a.
- 1 set of test leads.
- Student experiment manual.

optional items:

- Watt Meters for single-phase system	**LEM-WM1**
- Watt Meters for three-phase system	**LEM-WM3**
- Power Factor Meter	**LEM-PFM**
- Dynamometer, 20 nm capacity	**LEM-DYN1**
- Tachometer	**LEM-TCM**
- Single-Phase Load	**LEM-SPL**
- Three-Phase Load	**LEM-TPL**

(LEM3)
electrical motor system



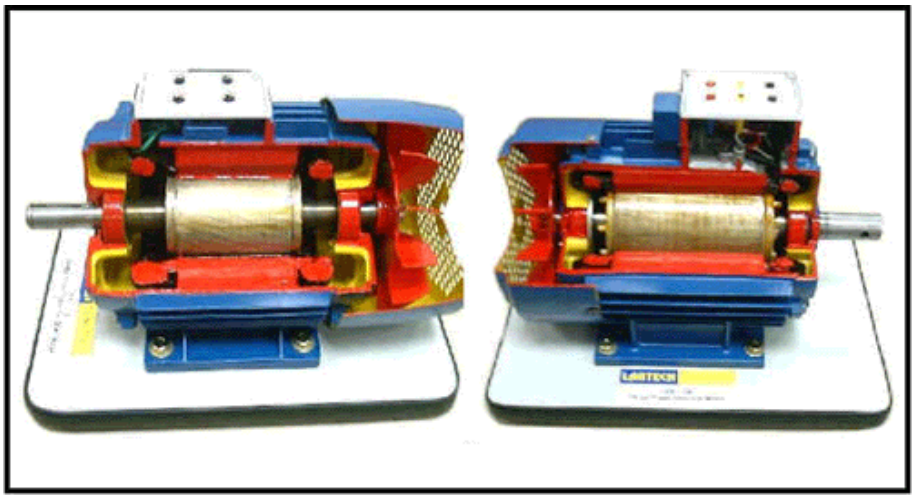
Item : electrical motors for training exercises
Model : LEM-EMS

The LEW-EMS electrical motor system consists of a wide range of multifunctional motor types commonly used in industrial applications. The electric motors listed below are specifically chosen for training applications in respect to the sizes and power output. All of these electric motors can be utilized in conjunction with the LABTECH electrical training systems. All motors have sturdy bases with all wiring connections brought out to 4 mm terminals. connection leads with banana plugs facilitate quick and easy connections between the motor and motor controls.

	motor	model no.
1.	dC shunt wound motor	**LEM-EMS-1**
2.	dC series wound motor	**LEM-EMS-2**
3.	dC compound wound motor	**LEM-EMS-3**
4.	aC single phase induction motor	**LEM-EMS-4**
5.	aC single phase split-pole motor	**LEM-EMS-5**
6.	aC single phase repulsion motor	**LEM-EMS-6**
7.	aC single phase universal motor	**LEM-EMS-7**
8.	aC three phase induction squirrel cage motor	**LEM-EMS-8**
9.	aC three phase induction pole changing motor	**LEM-EMS-9**
10.	aC three phase slip-ring motor	**LEM-EMS-10**
11.	aC three phase rotor wound motor	**LEM-EMS-11**
12.	aC single phase split-phase motor	**LEM-EMS-12**

LABTECH provides the above motors in power ranges from 0.20 kW (1/4 HP) to 3.0 kW (4 HP). We provide their power ranges so that the school may choose the type and size of motor that best meet their training needs. To indicate motors power rating, add onto the model number the size of the requirement in kilowatts (kW). For example LEM-EMS-10-3kW signifies an AC three phase slip ring motor with a 3 kW power rating. Special rating motors are available upon request.

(LEM4)
Sectioned Electrical Motors



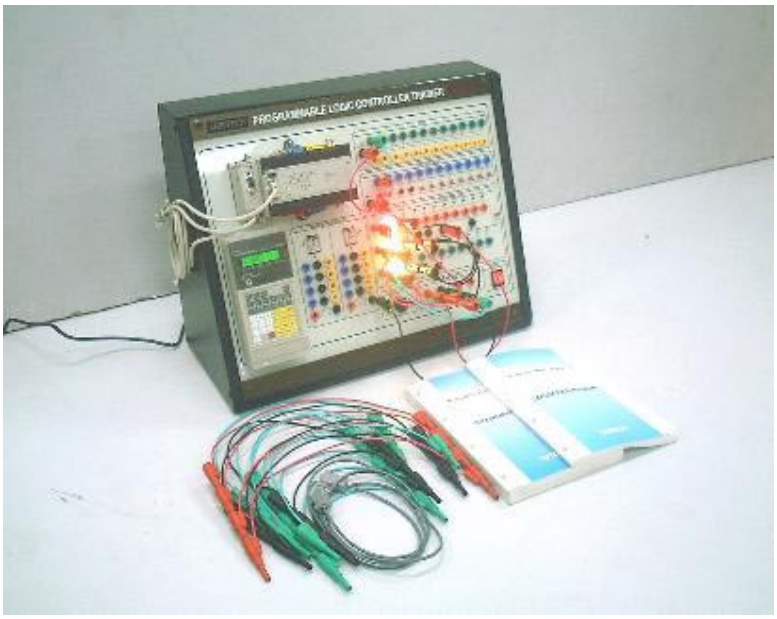
Item : Sectioned Electrical Motors
Model : LEM-1UM

These items are original electric motors, which have been carefully sectioned to expose all key operational parts. They are ideal for demonstrating to students the function and operation of different types of electric motors. A variety of sectioned motors are available so different operational characteristics can be compared. Motors are mounted on a melamine base and electrical connections are brought out to 4-mm terminals. Motors are available from 1/4 hp (187 watt) to 5 hp (3750 watt) depending upon the school's requirements. Most of the motors below feature a squirrel cage rotor, other types of rotors maybe provided upon request.

model available:

LEM-1UM	Sectioned universal motor for operation with 220 VAC or DC. common applications for universal motors are in vacuum cleaners, sewing machines and portable tools.
LEM-1CS	Sectioned single phase capacitor start-induction run (totally enclosed, fan cooled)
LEM-1SP	Sectioned single phase shaded pole motor (for low torque applications).
LEM-1SB	Sectioned single phase split-phase start and induction run motor. (moderate torque)
LEM-1DC	Sectioned direct current (DC) motor normally used for variable speed applications.
LEM-3IM	Sectioned three phase induction motor typically used for pumps, fans, blowers, machine tools, etc.
LEM-3SR	Sectioned three phase slip ring motor for use on pumping units and punch presses.
LEM-3SM	Sectioned three phase synchronous motor for special applications.
LEM-352	Sectioned three phase induction motor, Dahlander circuit used for applications that require 2 speeds.

(LDA1)
Programmable Logic Controller Trainer



Item	**:**	**Programmable Logic Controller Trainer**
Model	**:**	**LDA-PLC**

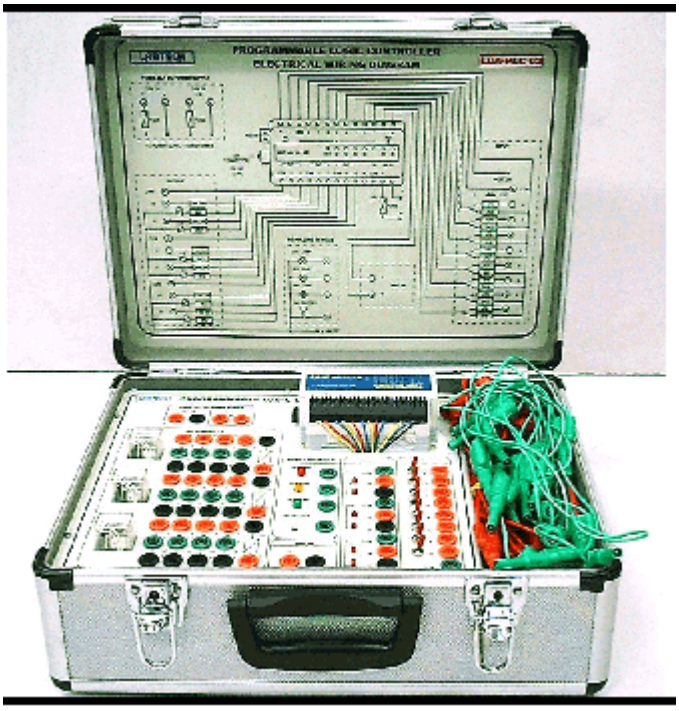
The Programmable Logic Controller Trainer uses Omron PLC products which are powerful and flexible systems ideally suited to your specialized needs. Omron is a leader in industrial automation and many factories commonly use their products. The systems in our trainers are compatible with a variety of accessories and peripherals, thus allowing them to be easily expanded into larger systems.

This trainer is suitable for the students to develop competence in operating, programming, and troubleshooting modern PLC control circuits. Several models of trainers are available in different sizes. These trainers are Basic Training Package, intermediate training package and advanced training package according to their difficulty level and equipments needed.

A student experiment manual is provided to guide the student through the experiments. The experiments are chosen to cover the topics from basic familiarization of the PLC up to programming and applications.

Toggle switches are provided on inputs so as to simulate and control the input to the PLC. LED indicators are used to monitor the status of the outputs. All connections are brought out to electrical terminals which use our stackable test leads to facilitate easy connections and measurement.

The Basic Training Package is self-contained and allows a number of experiments to be performed. The intermediate and advanced trainers use the LDA-RLC-A1 to perform a wider variety of experiments and applications.



Specification:

Basic training package: MODEL : LDA-PLC-01

This unit is a small PLC (20 I/O points) complete with several devices that enable onboard basic experimentation. This makes it ideal for introductory level PLC training. The unit comes with software for programming via a PC (PC is optional: LDA-PLT-PC):

1. PLC Trainer 24 V/2A DC load rating, 12 input and 8 output 20 point I/O with LED Indication.
2. Main voltage : 220 VAC, 50/60 Hz.
3. I/O 12 input switches, 6 LED output indicators
4. Signaling Devices: 3 units 24V lamp, 24V buzzer
5. Relay Modules: 3 units relays
6. 24 VDC Power supply
7. Computer programming software with ladder diagram

Intermediate Training Package: MODEL : LDA-PLC-02

This unit is a mid size compact PLC that features additional I/O points (up to 30 points). It allows for greater experimentation and is designed to use with applications board module for experimentation model (LDA-PLC-API). Unit comes with software for programming via a PC (PC is optional LDA-PLC-PC).

1. PLC trainer 24 V/2A DC load rating, 18 input and 12 output 30 point I/O with LED Indication.
2. Computer programming software with ladder diagram.
3. Main voltage : 220 VAC, 50/60 Hz.
4. I/O: 18 input switches, 12 LED output indicators
5. 24 VDC Power supply

Advanced Training Package: MODEL : LDA-PLC-03

This unit features a larger capacity compact PLC with 40 I/O points. It is ideal to use with the applications board module for experimentation (LDA-PC-API). The set comes with the handheld programmer which enables direct control of the PLC. Also the set includes software for programming via a PC (PC is optional (LDA-PLC-PC).

1. PLC Trainer 24 V/2A DC load rating, 24 input and 16 output 40 point I/O with LED Indication.
2. Computer programming software with ladder diagram.
3. Hand held console programming.
4. Main voltage : 220 VAC, 50/60 Hz.
5. I/O: 24 input switches, 16 LED output indicators.
6. 24 VDC Power supply

Advanced Training Package: MODEL : LDA-PLC-04

This unit features a larger capacity modular PLC (with 128 I/O) points with 128 I/O points, 3.2 k word program capacity RS 232 C part, 16 DC input points, 16 contact outputs. It is ideal to use with the applications board module for experimentation (LDA-PC-API). The set comes with the handheld programmer which enables direct control of the PLC. Also the set includes software for programming via a PC (PC is optional (LDA-PLC-PC).

1. PLC Trainer 24 V/2A DC load rating, 128 I/O, 16 DC input, 16 contact output with LED Indication.
2. Computer programming software with ladder diagram.
3. Hand held console programming.
4. Main voltage : 220 VAC, 50/60 Hz.
5. I/O: 24 input switches, 16 LED output indicators.
6. 24 VDC Power supply

Topic coverage :

- Basic PLC Trainer Familiarization.
- Hand held programming console.
- Basic programming.
- Inputting the program.
- Terminology.
- Mnemonic code.
- Ladder instructions.
- Logical continuity.
- I/O Devices.
- Equivalent user programs.
- Branch instructions.
- Latching instructions.
- Program development.
- Delete, copy, move, modify.
- The search function.
- The force function.
- Processor modes.
- Timers.
- Counters.
- Sequencers.
- Shift registers.
- Comparison instructions.
- Monitoring data files.

Accessories :

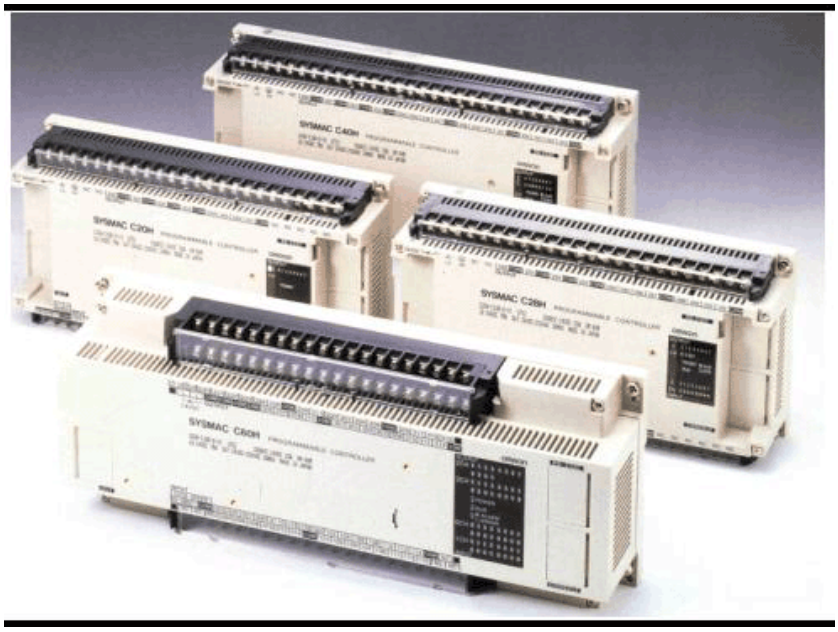
- Set of connection leads.

- Experiment manual

Optional Item :

- LDA-PLC-AP1 Application module featuring lights, relays, devices for general experiments.
- LDA-PLC-PC Personal Computer : AMD (700 MHz), 64 Mb RAM, floppy disk, SVGA color monitor, 10 Gb Harddisk, ASCII keyboard, Windows 98, manual book in English.
- LDA-PLC-PRT Printer: inkjet with connection cable manual book in English.
- LDA-PLC-HPU Hand Held Programmer unit for PLC.

(LDA2)
Industrial PLC Systems



Item : Industrial PLC Systems

LABTECH offers a number of industrial PLC systems, which are ideal for school or laboratory experimentation. These units are suitable for project work and for setting up experiments in order for the student to gain practical first hand knowledge and experience.

A variety of systems are offered with different capabilities and number of inputs and outputs. Also many peripheral devices are available which can enhance the function or performance of the system.

These systems are based upon Omron PLCs which are commonly used by industry throughout the world. These have special features such as advanced high-speed

CPUs, compact size, high speed counter, RS-232C interface, High I/O capacities, easy to maintain, built-in clock, multilingual displays

Systems and Accessories:

PLC UNITS:

		24VDC	250VAC
Model:	**Inputs:**	**Outputs:**	**Type of Output**
LDA-PCU-A1	12	8	Relay
LDA-PCU-A1	12	8	Transistor
LDA-PCU-B1	16	12	Relay
LDA-PCU-B2	16	12	Transistor
LDA-PCU-C1	24	16	Relay
LDA-PCU-C2	24	16	Transistor
LDA-PCU-D1	32	28	Relay
LDA-PCU-D2	32	28	Transistor

Note: Maximum switching capacity is 2A for 250 VAC and 24VDC.

Expansion I/O module can be ordered by using the above number followed by a suffix "X: (i.e. LEW-PCU-D1X)

Accessories:

LDA-PCA-1: PC Computer System for interfacing with the PLC. Unit includes PC with printer and connecting cables.

LDA-PCA-2: Ladder Software for PC Computer

LDA-PCA-3: Hand held programming console with LCD Screen. Incorporates also data access console function.

LDA-PCA-4: EPROM writer

LDA-PCA-5: Floppy Disk interfaces Unit

LDA-PCA-6: Printer Interface Unit

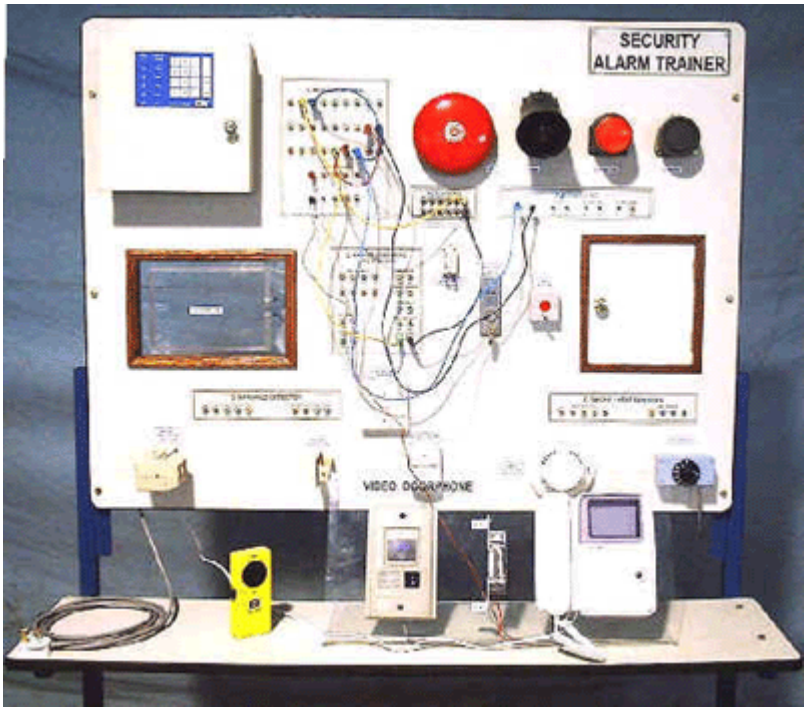
LDA-PCA-7: Input Simulator 12/8

LDA-PCA-8: Input Simulator 16/12

LDA-PCA-9: Input Simulator 24/16

LDA-PCA-10: Input Simulator 32/28

(LLC1)
Security Alarm Trainer



Item : Security Alarm Trainer
Model : LLC-SAT

The LABTECH Security Alarm Trainer is designed to introduce students and technicians to basic security alarm systems. The security industry is a fast growing sector in many economies that requires skilled technicians for installation and maintenance of alarm systems

This trainer will teach prospective technicians about the characteristics of alarm systems, function of the various components, placement and use of alarm sensors, set up and programming of electronic controls, installation, maintenance of security systems, fault finding and troubleshooting

This system is based upon a programmable electronic microprocessor based central alarm unit that is equipped with many types of the most common sensors and signaling devices. The security system is clearly laid out on a panel type mobile frame that allows for easy wiring and connection

Electrical wiring connections for all components are mad by 4mm terminals which permits exercises to be performed quickly. Courseware is provided with an instruction book, job sheets and factory information sheets/manual on the various components. Set of connection leads are included.

TECHNICAL SPECIFICATIONS:

The trainer consists of a number of different panels or stations which each contain a variety of components that have been pre-wired to 4mm terminals. Each terminal is labeled with a coded number that relates back to the instruction manual. This coding system allows the students to easily and quickly wire up the components utilizing the 4mm connection leads.

1. **CENTRAL CONTROL PANEL:** This is a programmable electronic microprocessor based central alarm control station featuring multi zones for burglar, fire and emergency (panic) applications. Programmable features include entry/exit delay time, individual zone loop response time, siren timer, entry/exit alert enable. Fire and Panic Zones are activated 24 hours for constant monitoring.

2. **SIGNALING DEVICES:** Several types of commonly used visual (light) and audio (sound) devices are included: alarm bell (100mm diameter), sound siren (two tone type), strobe light, alarm buzzer (piezo electric type).

3. **ARMING/DISARMING AND SENSORS:** Several types of common door and window sensors are included in this panel: foil type window sensor, glass breakage detector (motion type), magnetic contactor, tamper switch, vibration sensor, contact switch. Also two types of arming and disarming controls are included, they are a key lock switch for controlling the main control station remotely and a panic button for activating the alarm system during emergency.

4. **INFRARED DETECTOR DEVICES:** Two types of infrared sensors are used. The first is a PIR (passive infrared) motion detector used for detecting the movement of humans. The second is an infrared photo relay sensor which is a beam type trip alarm that can sense when a person or object passes through the beam.

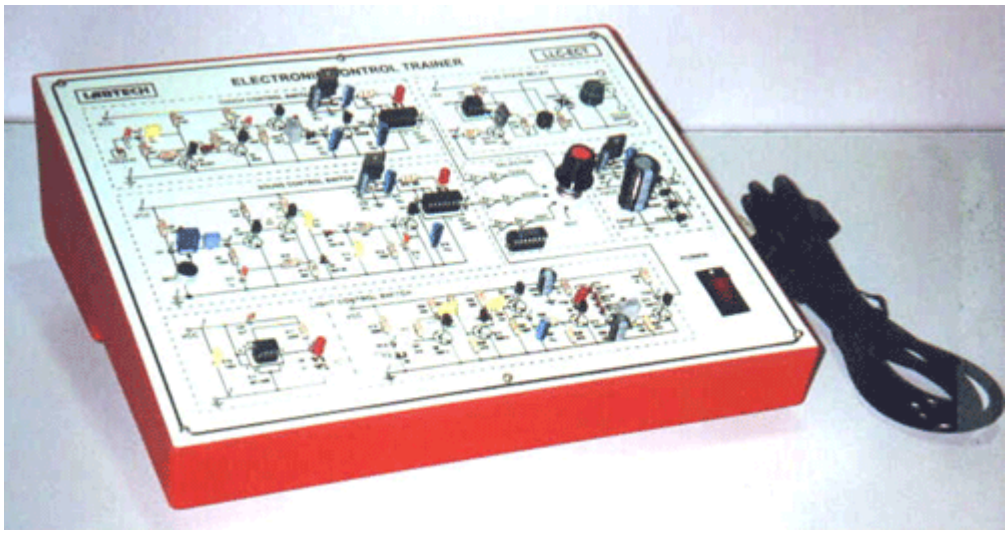
5. **SMOKE/HEAT SENSORS:** A smoke detector and a heat sensor are included for fire detection.

6. **MOBILE FRAME:** All components are mounted onto a melamine/wood panel type frame that has steel legs. Steel is coated with epoxy paint. Wheels are provided for mobility.

7. **ACCESSORIES:** Instruction Book, Student Job Sheets, Factory Information Sheets, Set of Connection Leads.

8. **POWER REQUIREMENTS:** 220VAC, 1 Phase, 50Hz or 110VAC, 1 Phase, 50Hz.

(LLC2)
Electronic Control Trainer (SSR)



Item : Electronic Contero Trainer
Model : LLC-ECT

This trainer provides a comprehensive course an Solid State Relays (SSR) and their applications. SSR's are typically used as the modern replacement to conventional electromagnetic relays. SSR's generally provide more flexibility in their control applications and easily combine low voltage and high voltage circuits working in conjunction with each other. This trainer also provides a good introduction to semiconductor applications and theory.

The trainer features three low voltage circuits which controls the solid State Relay that in turn controls a higher voltage circuit. The low voltage circuits include a touch operated switch circuit, a sound operated switch circuit and an optical photo relay switch. These circuits are all 6VDC for student safety. A mode selection switch is used to determine which low voltage circuit will control the SSR. The SSR will then be turned off or on by this circuit. The SSR has an output of 220 VAC, single phase, 50 Hz, 16 amp and can control electric motors, lights or any other electrical device.

These circuits provide the platform from which experiments can be done according to the accompanying text. The text which is over 100 pages covers the basic types of semiconductors, details on the touch control switch, details on the construction of the sound control switch, details on the Photo-Optical switch, comparison of electromechanical relay to SSR's, characteristics of SSR and basic SSR design applications. SCR and TRIAC basics are also covered. The Student Job Sheet sectioned includes 17 detailed experiments for the student to follow.

(LLC3A)
Solar Energy Trainer

Item : Solar Energy Trainer
Model : LLC-SET-1 HOT WATER SOLAR PANEL TRAINER
LLC-SET-2 TRAINER WITH ELECTRICAL ENERGY PANELS

This trainer is specifically designed as an educational tool. Small and compact in design for easy use in classroom and remote site. Students may use this trainer by moving through selected basic activities before moving through more advanced tasks. In this trainer, we are introducing the Kcal (BTU) measurements and calculate the heat absorbing capacity of solar panels. These measurements require the familiarization of the flow meters and the electronic thermometer which are provided on the control panel. Student can compare their output and efficiency by assembling their own collectors using the interchangeable parts supplied with the units.

Comparisons include black versus white back ground, metal versus fiber collector plate, double glazing versus single glazing versus no glazing, back panel insulator versus no insulation. For

advanced students, the units have flexible, detachable water piping for space heating, domestic hot water heat, heat storage and many more.

LLC-SET-2 : Is similar to the water solar trainer but features several solar photo voltaic panels to generate electricity which can power the fan and other devices on trainer.

SPECIFICATIONS:

Solar Panels: Two Solar Panel Frames with adjustable Solar Incidence Angle. Includes glazing to improve efficiency.

Solar Collector Panels: Includes Three Solar Collector Panels each with (62 cm x 73 cm = 4.85 sq. ft (45.26 sqmt)) Solar Collection Surface (1 x Black, 1 x White, 1 x Fiber) with different Solar Absorption rates. These panels are interchangeable and can be mounted in the Solar Panel Frames in various combinations.

Water Storage Tank: Capacity approx. 7 Gallons (26.7 lt)

Water Circulation: Electric pump is provided with tubing, manifold and valves so as to route the water in various configurations. Complete with flow meter.

Heat Exchanger: Finned Coil type heat exchanger with fan for forced air convection.

Instrument Controls: On/Off switch with indicator lights for pump and fan. 5 digital thermometer with probes that can be put in various positions. Valve to control water flow

Optional additional Black Solar Collector Panel (LLC-SET-P1)

(LLC3B)
Solar Energy Trainer, Boiler Type

Item : Solar energy Trainer Boiler Type
Model : RAC-SHW-1

This trainer represents a state-of-the-art high tech solar hot water heating system as is now being introduced for use in residential and commercial applications. It features a high efficiency solar collector with a separate boiler (hot water storage tank) that also has a supplementary electric heater. The supplementary electric heat system is a back up unit to ensure that the water is always a constant temperature no matter what the solar conditions and also compensates for heavy demand usage.

It comes complete with a centralized electronic controller that operates the unit, electronic temperature meter with six temperature sensors, two water flow meters, expansion tank, electrical circulating pump, water pressure gauge, pressure relief valve, hot water storage tank and the solar collector. The trainer also has a silk-screened diagram of the solar collection and control circuit, which aids in the explanation of the operation of the system.

The solar collector plate features the latest technology Thermomax system which has vacuum evacuated heat collector tubes that provide maximum efficiency. A standard conventional flat plate collector is also available as an option so that efficiency comparisons can be made between two types of collector designs.

Technical Specifications:

1. Domestic Hot Water Tank: 200 liters, with solar heating circuit, electrical heater supplement, and immersion thermostat.
2. Thermomax Solar Collector with 20 Thermomax vacuum evacuated glass tubes. Collector size 2.3 X 2.0 meters (4.6 square meters). Primary collection circuit is glycol. The Collector plate unit angle is adjustable to

compare efficiency at various angles to the sun. The Thermomax system can achieve efficiencies up to 68% and heats the primary collection circuit up to 239.5 degrees C. Please note performance depends upon ambient conditions.

3. Controls and Instrumentation: The system features an electronic micro-controller with sensors. The micro-controller monitors all the relevant temperatures and records the solar activity over a period of six months. The system also includes two water flow meters, water pressure gauge, electronic temperature meter with six thermocouples.

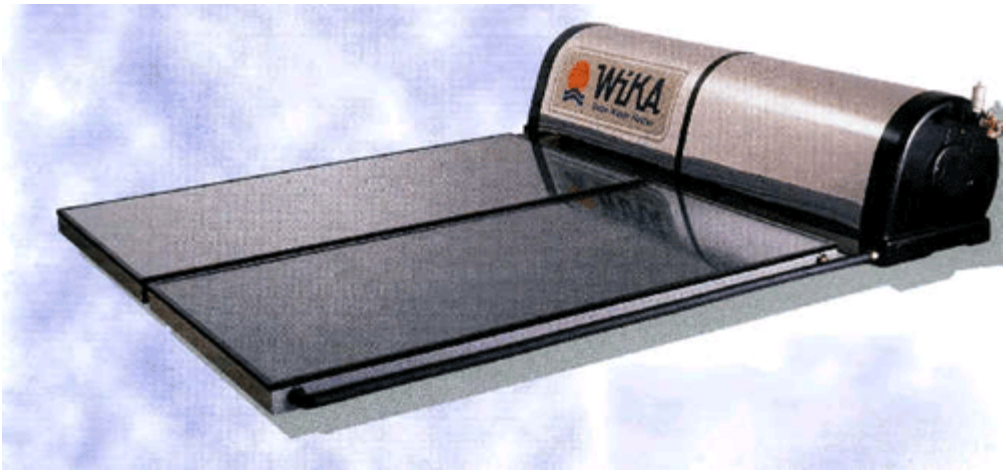
4. Accessories: expansion tank, electrical circulating pump, pressure relief valve, 2 safety/control valves, 2 non return check valves, one manual air vent, one automatic air vent, drain valve.

The Thermomax System – How it works:

The Thermomax Solar Collector system converts direct and diffused solar radiation into heat. The energy is collected and transferred through a collector plate and "heat pipe" (an evacuated glass tube) to a highly insulated manifold heat exchanger. The collector plate has a special wavelength "selective" coating using a semi-conductor layer. This special absorber material converts the maximum amount of solar radiation into heat. Infrared rays, which can pass through clouds, are also absorbed and converted into usable heat. Transfer of heat from the absorber plate to the water is via an efficient and very fast heat conductor, the heat pipe. This has a very low heat capacity but an exceptionally rapid conductivity. The "heat pipe" also provides the system with a diode function i.e. heat transfer is always in one direction from the absorber to the water and never the reverse. Due to the physical properties of the 'heat pipe' fluid and the special construction of the condenser the maximum working temperature of the system can be controlled. This unique feature eliminates the need for complicated controls and ensures safety in the system.

The special fluid inside the 'heat pipe' evaporates when heated, transferring heat energy to its top and vapor condenses inside a special condenser and the fluid then returns to its original position at the bottom of the 'heat pipe', due to gravity and the cycle is repeated continuously. The vacuum in the glass tube, being the best possible insulation for a solar collector suppresses heat losses and also protects the absorber plate and the 'heat pipe' from external adverse conditions

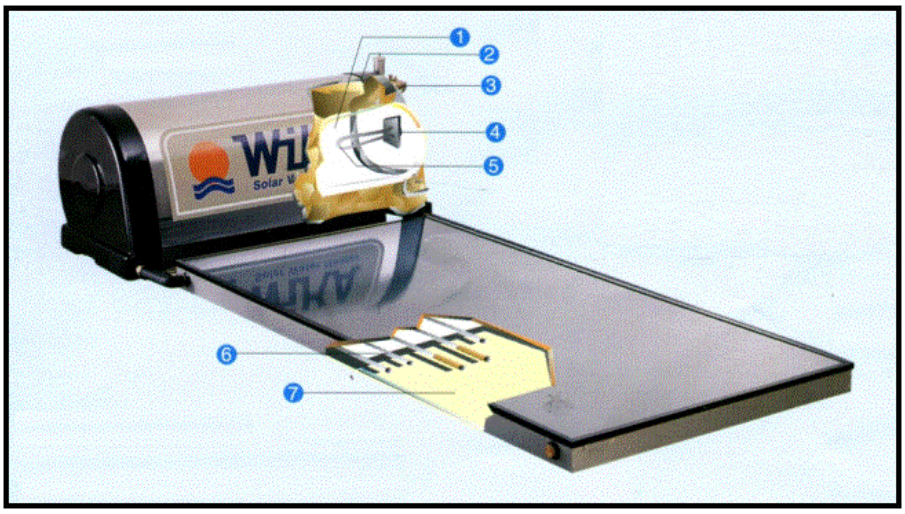
(LLC3C)
Solar Energy Hot Water System Trainer



Item : Solar Energy Hot Water System Trainer
Model : LLC-SHW-2A System With One Collector And 145 Liter Tank
LLC-SHW-2B System With Two Collectors And 280 Liter Tank

This Trainer is based upon the types of solar hot water heaters that are in common use for residential and commercial applications. It features a high efficiency solar collector with a integral hot water storage tank that also has a supplementary electric heater. The supplementary electric heat system is a back up unit to ensure that the water is always a constant temperature no matter what the solar conditions and also compensates for heavy demand usage.

The system operates on the thermosyphon principle in which the power of the sun light circulates the water from the collector plate into the storage tank. It comes complete with a thermostat controller that operates the and controls the electric booster unit, electric booster system, Stainless steel water storage tank, polyurethane insulation, pressure and temperature relief valve, advanced solar absorption collector panel. The system also includes control panel unit that features four temperature sensors, water flow meter, water pressure gauge. The trainer also has a silk-screened diagram of the solar collection and control circuit, which aids in the explanation of the operation of the system.



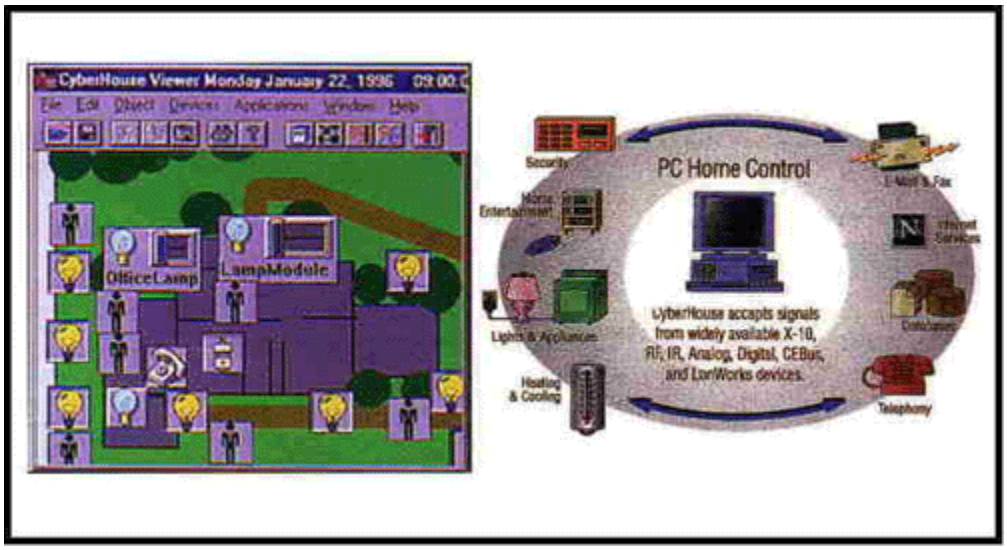
1. **Stainless Steel Tank**
   Corrosion free to ensure the long life time of product and preserve water quality.
2. **Polyurethane Insulation**
   Polyurethane is the best insulation material to minimize the heat loss of the storage hot water.
3. **Pressure and Temperature Relieve Valve**
   Is a safety device of the storage tank against over pressure and over temperature of vacuum condition.
4. **Thermostat**
   It's adjusted to keep the availability of hot water anytime with minimum amount of electric energy.
5. **Electric Booster**
   It is an auxiliary heater at the cloudy or no sunshine condition.
6. **New Absorber Design**
   Increase the acceleration of heating process and improve the absorption efficiency of solar energy.
7. **Glasswool Insulation with Aluminum Foil Layered**
   Reduce radiation heat loss from the backside of the absorber plate and increase the performance of collector panel.

DESCRIPTION	LLC-SHW-2A	LLC-SHW-2B
STORAGE TANK		
Capacity	145 liters	280 liters
Material		Stainless Steel
Insulation		Polyurethane
Auxiliary Heater	900 watts	1500 watts
Max. Working Pressure		4 bars
Empty Weight	42 kgs	72 kgs
Water Full Weight	187 kgs	352 kgs
Dimension (LxWxH) mm	1220 x 560 x 525	2235 x 560 x 525
COLLECTOR PANEL		
• Surface Area	1.85m^2	2 units @ 1.85m^2
Absorber Plate		Aluminum
Water Path		Cooper Tube
Collector Box		Aluminum
Top Cover		Tempered Glass 5mm
Insulation		Glasswool & Aluminum Foil
Empty Weight	42.5 kgs	85 kgs
Water Full Weight	45 Kgs	90 Kgs
Dimension (LxWxH) mm	2000 x 1000 x 75	2 @ (2000 x 1000 x 75)

Technical Specifications:

1. Domestic Hot Water Tank: 145 liters (LLC-SHW-2A) or 280 liters (LLC-SHW-2B), with solar heating circuit, electrical heater supplement, and immersion thermostat.
2. Solar Collection Panels: Featuring a flat panel type collector with insulation and weatherproof glazing (glass covering).
3. Controls and Instrumentation: The system features and thermostat controller with sensor. The system also includes t water flow meters, water pressure gauge, and electronic temperature meter with four thermocouples.
4. Accessories: Stand and mounting are included. The system is ready to operate and hook up to an existing water connection. Can be used to provide hot water for the lab as well as training purposes.

(LLC4)
Building Automation Trainer


CyberHouse Viewer Monday January 22, 1996
Office Lamp
Lamp Module
PC Home Control
CyberHouse accepts signals from widely available X-10, RF, IR, Analog, Digital, CEBus, and LonWorks devices.
Security
Lights & Appliances
Heating & Cooling
Telephony

Item : Buliding automation trainer
Model : LLC-BAT

The LABTECH Building Automation Trainer is designed to introduce students and technicians to building automation control systems. The Building Automation is a fast growing sector in industry because of the demand on automatic control of electronic components such as appliances, communication devices, alarm systems etc. Therefore a large number of skilled technicians and designers are required for installation and maintenance of building automation systems. The trainer will teach the students about the characteristics of building automation components, function of each component and the installation procedures. The experiment manual will guide the student to create a complete computerized building automation system with step by step clear explanation on every component functions.

This Building Automation Trainer is based upon a computer control system uses the PC for complete control and monitoring on various installed components such as lights, appliances, telephone, home entertainment, security alarm system, temperature control, etc.

All components will be mounted on clear acrylic panels with terminal connections and component identifications. A three level mobile frame is provided for panel configurations and connections. Connections are made by 4 mm terminals and jumper cords which permits practical exercises to be performed quickly and allows the students to do all connections. Courseware is provided with an instruction book, job sheets and factory information sheets on the various components. Set of connection leads are included.

Technical Specifications:

The trainer consists of a number of different panels which each contain a variety of components that have been prewired to 4 mm terminals. Each terminal is identified with a

coded number that relates back to the instruction manual. This coding system allows the student to easily and quickly wire up the components utilizing the 4 mm connection leads.

1. **Central Control Panel**
   This is a computerized control and monitoring station. Special software is provided and is installed in a PC with the interface. The PC is then functions as the central control and monitoring station. A complete PC computer system is provided as well as the software.
2. **Control Modules**
   A control module is a component that can be controlled from the control station. Several aspects can be controlled such as ON/OFF operation, timer control, dimmer control, temperature control etc.
3. **Infrared Devices**

   These devices consist of infrared motion detectors with flood lights, infrared motion detector without floods lights and infrared transceiver.
4. **Others Devices**
   - Photocell sensor (to sense daylight or night)
   -Light module (for general room illumination)
   -Thermostat control (for heating/cooling applications)
   -Video monitoring system (for security & communications applications)
   -Key pad (for direct access to control system)
   -Signaling device (siren, buzzer, strobe light)
   -Heat sensor (for fire detector)
5. **Three Level Mobile Frame**
   The frame is a three level steel frame with aluminum slots for the mounting of component panels.
6. **Accessories**
   Instruction Book, Student Job Sheets, Factory Information and a set of connection leads.
7. **Power Requirement**
   220 - 240 VAC/50 Hz or 110 - 130 VAC/60 Hz.

6. Variable AC&DC Power Supplies:

LPS-VPS-6A:
Variable 400VDC Power Supply,
Input: 220 VAC, 1 Phase, 50 Hz
Output: 0-400VDC, 1 Amp
Meters: Voltmeter, Ammeter

LPS-VPS-6B:
Variable 24VDC Power Supply,
Input: 220VAC, 1 Phase, 50 Hz
Output: 0-24VDC, 20 Amps
Meters: Voltmeter, Ammeter

7. Isolation Transformer:

Portable type heavy duty isolation transformer ideal for educational lab work.
Input: 220 – 240VAC, 2A, 1 Phase
Output: 0 – 240VAC, 2A, 1 Phase
Output via 13A socket
Controls:
On/Off switch
Fused input 2A

Models:
LPS-IST-1: 500VA Rating
LPS-IST-2: 1000VA Rating

(LPS2)
Panel Mounting Frames And Storage Cabinets For Electrical Panel Trainers

ITEM : Panel mounting Frames and storages Cabinets for Electrical Panel Trainers

Training Panel Frames

Frames are used for the mounting of the panel modules and can accommodate sizes of A3, A4, A5 and A6. Frames are available in two different styles for bench top or stand alone mobile units. All frames feature the special LABTECH aluminum profile rails, which are designed to accept our 5mm transparent training module panels. These rails allow the panels to be quickly and securely mounted into position yet easily removed. The mobile frames are mounted onto castor wheels and include a working surface, which is handy for placing test equipment or special modules during experimentation, also the units have a shelf for storage of panels not in use. The bench top frames have strong steel legs for support and stability

Storage Cabinet for The Panel Modules

Several Storage Cabinets are available for the storage of the panel modules for our various trainers. The cabinets are fitted with slots into which the panels can be secured. The cabinets will keep the modules clean and prevent damage from improper storage

Training Panel Frames

LPS-TPF-2: Three level bench top frame with four rails
Height: 1100mm Width: 900mm

LPS-TPF-1 Two level bench top frame with three rails
Height: 850mm Width: 900mm

LPS-TPF-3 Two level mobile frames with four rails
Height: 1700mm Width: 1100mm

LPS-TPF-4 Three level mobile frames with four rails
Height: 1850mm Width: 1100mm

STORAGE CABINETS:

LPS-SCP-1 Filing Cabinet Type Storage Unit: Consists of a cabinet with four sliding drawers similar to a filing cabinet. Each drawer is fitted with slots for storage of the panels.
Dimensions: Width: 465mm, Height: 1300mm, Depth: 620mm

LPS-SCP-2 Double Door Storage Cabinet Unit: Consists of a steel full height Double door cabinet with four shelves. Each shelf is fitted with Slots for storage of the panels.
Dimensions: Width: 950mm, Height: 1850mm, Depth: 495mm